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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 9
MAY 1, 1979

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 9
MAY 1, 1979

W79-04001--W79-04500

he Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the ansaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

BEHAVIOR OF A MICRO FLOWTHROUGH COPPER ION-SELECTIVE ELECTRODE SYSTEM IN THE MILLIMOLAR TO SUBMICROMOLAR CONCENTRATION RANGE,
Wisconsin Univ.-Madison. Dept. of Chemistry.
W. J. Bladel, and D. E. Dinwiddie.
Analytical Chemistry, Vol. 47, No. 7, p 1070-1073, June 1975. 7 fig, 1 tab, 10 ref. OWRT A-053-WIS(3).

Descriptors: *Electrodes, *Ions, *Water chemistry, *Copper, *Flow system, Electrochemistry, Measuring, Electrolytes, Water analysis, Trace elements, Water properties, Sampling.

The construction and behavior of a gravity-fed micro flowthrough electrode system fabricated from commercially manufactured silver sulfide-cupric sulfide pellets are described. Details of the fabrication of the micro copper ion-selective electrodes, the flowthrough cell, the solution flow system, and the procedure for the measurement of potentials are presented. The system response time to steady-state potentials in the supermicromolar region was similar to responses previously reported for flowing systems. The stability and reproducibility of the system in the supermicromolar region were good. It is concluded that a steady-state potential is approached on immersing the electrode in a solution of copper ion that appears to be Nernstian within 1 mV down to copper ion concentrations of 10 to the minus 8M for highly different modes of pretreatment. The deviation from Nernstian potential of the nominal 10 to the minus 9M solution correspond to a blank copper concentration of about 1 x 10 to the minus 9M. (Davison-IPA)
W79-04102

APPLICATION OF ION EXCHANGE MEMBRANES TO SAMPLING AND ENRICHMENT: INTERFERENCE OF METAL ION BINDING GROUPS,
Wisconsin Univ.-Madison. Dept. of Chemistry.
W. J. Blaedel, and R. A. Niemann.
Analytical Chemistry, Vol. 47, No. 8, p 1455-1457, July 1975. 1 fig, 20 ref. OWRT A-053-WIS(4).

Descriptors: *Ion exchange, *Membranes, *Evaluation, *Cation exchange, Pollutants, Copper, Distribution patterns, Laboratory tests, Absorption, Radioactive tracers, Spectrophotometry.

A study was undertaken to demonstrate that ion exchange membranes contain impurity groups capable of binding the metal ion very strongly by mechanisms other than the ion exchange mechanism. The three types of sulfonated cation exchange membranes studied were: (1) AMF C-103; (2) Nafion XR-170; and (3) Permion P1010. A weighted piece of each membrane placed in a laboratory prepared solution containing known concentrations of copper and radiotracer, 64 copper, and mechanically stirred for eight hours. A fraction, 5 to 10%, of the copper was taken up by the membrane, and the copper content and distribution ratio of the membrane were determined from the counting rate of the solution before and after the membranes were extracted from the solution. The Nafion and Permion membranes were subjected to the radiotracer technique for measurement. Since the AMF membrane contained a higher level of impurity groups, atomic absorption was used in measurement. Transmission infrared spectra were taken on pieces of membrane in the sodium form. Spectra acquired with the hydrogen forms of ion exchange membranes were not interpretable. It is concluded that ion exhange membranes of the sulfonic acid type contain impurity groups, some of which bind copper ions strongly. These impurity groups interfere with normal ion exchange behavior at low concentration levels of copper ion, which may preclude use of the membrane in some procedures for trace analysis. (Davison-IPA)
W79-04103

A STUDY OF LOUISIANA'S MAJOR ESTUARIES AND ADJACENT OFFSHORE WATERS,
Louisiana Wildlife and Fisheries Commission, New Orleans.
For primary bibliographic entry see Field 2L.
W79-04156

TRANSIENT PRESSURE ANALYSIS IN GEOTHERMAL STEAM RESERVOIRS WITH AN IMMOBILE VAPORIZING LIQUID PHASE--SUMMARY REPORT,
Geological Survey, Menlo Park, CA. Water Resources Div.; and Union Oil Company, Santa Rosa, Calif.
A. F. Moench, and P. G. Atkinson.
In: Proceedings of the Third Stanford Workshop on Geothermal Reservoir Engineering, Stanford University, California, December 14-16, 1977. 6 p, 3 fig, 1 ref.

Descriptors: *Geothermal studies, *Thermal water, *Steam, *Vapor pressure, *Model studies, Heat transfer, Condensation, Wells, Aquifers, Permeability, Porosity, Water yield, Drawdown, *Finite-difference models, Phase change, Radial flow.

A finite-difference model for the horizontal, radial flow of steam in the presence of an immobile vaporizing or condensing liquid phase was adapted from the model of Moench (1976). Results were generated for real physical oarameters, and are presented in terms of standard dimensionless pressure (actually pressure-squared) and time groupings. The analysis assumes an initial constant temperature and pressure in the aquifer and an initial uniform liquid-water distribution which partially fills the void space. It is also assumed that the steam and liquid water in the reservoir are in local thermal equilibrium with the reservoir rocks and that temperature changes occur only in response to phase changes. (Woodard-USGS)
W79-04410

GEOCHEMISTRY OF GEOPRESSURED GEOTHERMAL WATERS FROM THE TEXAS GULF COAST,
Geological Survey, Menlo Park, CA. Water Resources Div., and Geological Survey, Reston, VA. Water Resources Div.
Y. K. Kharaka, E. Callender, and W. W. Carothers.
In: Proceedings of the Third Geopressured-Geothermal Energy Conference, Vol. 1, University of Southwestern Louisiana, Lafayette, Louisiana, November 16-18, 1977, p GI-121-GI-165, 1978. 10 fig, 1 tab, 35 ref.

Descriptors: *Geochemistry, *Geothermal studies, *Chemical analysis, *Water analysis, *Texas, Oil fields, Thermal water, Energy, Membranes, Vapor pressure, Temperature, Salinity, Dissolved solids, Data collections, Evaluation, *Gulf Coast, *Brazoria County, *Galveston County, *San Patricio County.

Waters with abnormally high pressures and temperatures are present at depths greater than about 3,000 meters in Cenozoic and Mesozoic sedimentary rocks beneath an area of about 350,000 sq km in coastal Texas and Louisiana. There is an intensive effort to determine the feasibility of using these geopressured geothermal waters as a source of energy. Three forms of energy may be extracted from these waters: (1) Thermal energy, (2) mechanical (hydraulic) energy, because these waters will be under high pressure at ground level, and (3) energy obtained from dissolved gases, mainly methane, which may equal the thermal energy (Papadopulos et al, 1975) provided the waters are saturated with natural gas under subsurface conditions. This paper reports detailed chemical analyses of 48 formation and 4 shallow ground-water samples obtained from 10 oil and gas fields in the Houston-Galveston and Corpus Christi areas of Texas. Deuterium and 0-18 analyses for 25 of these samples also are included. Procedures and equations, based on the chemical geothermometers and vapor-pressure data for water at the subsurface conditions are given to identify samples diluted by condensed water vapor produced with natural gas and to estimate their true salinities. The formation waters were obtained from geopressured and normally pressured production zones ranging in depth from about 1,000 to about 4,300 m. (Woodard-USGS)
W79-04414

1B. Aqueous Solutions and Suspensions

WATER: A COMPREHENSIVE TREATISE. (VOL. 5). WATER IN DISPERSE SYSTEMS.
Plenum Press, New York and London, C1975. Franks, F. (editor). 366 p, 732 ref.

Descriptors: *Water properties, *Dispersion, Chemical reactions, Water, Hydration, Capillary action, Foaming, Emulsions, Colloids, Thin films, Clays, Thermodynamic behavior, Water structure, Dynamics, Adsorption, Water types, Biopolymers, Clay-water systems, Textbooks.

The 6 chapters by different experts deal with the influence of hydration on the stability of colloidal hydrophonic systems; the properties of water in capillaries and thin films; hydration and the stability of foams and emulsions; clay-water systems; adsorption of water on well-characterized solid surfaces; and specific interactions of water with biopolymers (thermodynamic, structural, and dynamic properties of sorbed water). A bibliography and subject, author, and compound indexes are appended. (Brown-IPC)
W79-04257

SUSPENDED SOLIDS IN WATER.
For primary bibliographic entry see Field 2L.
W79-04258

2. WATER CYCLE

2A. General

QUALITY AND MOVEMENT OF GROUND WATER IN OTTER CREEK - DRY CREEK BASIN, CORTLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
W. Buller, W. J. Nichols, and J. F. Harsh.
Geological Survey Water-Resources Investigations 78-3 (open-file report), 1978. 63 p, 24 fig, 10 tab, 27 ref.

Descriptors: *Groundwater movement, *Water quality, *Aquifers, *Observations wells, *Water pollution sources, Chlorides, Nitrates, Groundwater recharge, Water levels, Surface-groundwater relationships, Model studies, Digital computers, New York, *Cortland County, Otter Creek-Dry Creek basin.

A steady increase in the chloride and nitrate content of water in a sand and gravel aquifer of glacial origin in the Cortland, N.Y., area prompted a study to obtain data on the extent and source of these constituents. Chloride concentration in the upper part of the aquifer increased generally from 2 mg/liter in 1930 to 20 mg/liter in 1976, and nitrate concentration (as nitrogen) in the upper part of the aquifer increased from 1 mg/liter in 1930 to an average of 4 mg/liter in 1976. Although the ground water is normally very hard, its quality generally meets State standards for source waters used for drinking. Road salting and farming seem to be the primary cause of chloride increases, although septic systems may be a major source locally. Farm-animal waste, sewage systems, and fertilizers are the major contributors of nitrate to ground water. Flow in the aquifer system in the Otter Creek-Dry Creek basin was simulated with a digital-computer model. The model was calibrated by comparing measured water levels in the aquifer

with those determined by the model. The major sources of recharge are from precipitation and seepage from losing reaches of the streams. (Woodard-USGS)
W79-04035

CLIMATE, SOIL, AND VEGETATION--1. INTRODUCTION TO WATER BALANCE DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol 14, No 5, p 705-712, October 1978. 8 fig, 16 ref.

Descriptors: *Water balance, *Model studies, *Statistics, Mathematical models, Computer models, Rainfall, Precipitation(Atmospheric), Infiltration, Percolation, Groundwater, Water table, Soils, Soil properties, Vegetation, Evapotranspiration, Evaporation, Soil water, Soil moisture, Runoff, Fluid mechanics, Water balance dynamics.

A statistical dynamic formulation of the vertical water budget at a land-atmosphere interface was outlined. Physically based dynamic and conservation equations expressed the infiltration, exfiltration, transpiration, percolation to groundwater, and capillary rise from the water table during rainstorms and interstorm periods in terms of independent variables representing the precipitation, potential evapotranspiration, soil and vegetal properties, and water table elevation. Uncertainty was introduced into these equations through the probability density functions of the independent climatic variables and yields derived probability distributions of the dependent water balance elements: surface runoff, evpotranspiration, and groundwater runoff. The mean values of these quantities give a long-term average water balance which, to the first order, defines the annual water yield and water loss in terms of the annual precipitation and potential evapotranspiration and in terms of physical parameters of the soil, vegetation, climate, and water table. This analytical framework provides physical insight into the dynamic coupling of climate-soil-vegetation systems. Details were presented in a series of subsequent papers. (See W79-04038 thru W79-04043) (Sims-ISWS)
W79-04037

CLIMATE, SOIL, AND VEGETATION--6. DYNAMICS OF THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 749-764, October 1978. 11 fig, 4 tab, 20 ref. NSF ENG76-11236.

Descriptors: *Water balance, *Model studies, *Mathematical models, Statistics, Soil properties, Soils, Soil moisture, Evapotranspiration, Runoff, Surface runoff, Subsurface runoff, Vegetation, Biomass, Precipitation(Atmospheric), Rainfall, Probability, Equations, Infiltration, Soil water, Groundwater, Water balance dynamics.

Mass conservation was employed to express the natural water balance of climate-soil-vegetation systems in terms of the average annual values of precipitation, evapotranspiration, surface runoff, and groundwater runoff as derived from the probability distributions of storm properties and from the physics of the appropriate storm and interstorm soil moisture fluxes. The resulting conservation equation was used to define the dimensionless parameters governing the dynamic similarity of the annual water balance. An asymptotic analysis of this water balance equation yielded a set of rational criteria for the classification of climate-soil-vegetation systems. Sensitivity with respect to the primary climate, soil, and vegetal parameters demonstrates that qualitative changes in water balance behavior are primarily dependent upon the exfiltration effectiveness of the soil. A natural selection hypothesis was presented which specifies the stable vegetation density and the plant coefficient for a given climate-soil system in which water and not nutrition or light is limiting. (See also W79-04037) (Sims-ISWS)
W79-04042

CLIMATE, SOIL, AND VEGETATION--7. A DERIVED DISTRIBUTION OF ANNUAL WATER YIELD,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 765-776, October 1978. 10 fig, 3 tab, 13 ref. NSF ENG76-11236.

Descriptors: *Water balance, *Soil water, *Water yield, *Model studies, Water resources, Precipitation(Atmospheric), Rainfall, Soil moisture, Soil water, Soil water movement, Vegetation, Evapotranspiration, Runoff, Infiltration, Soil properties, Equations, Frequency, Statistics, Probability, Climates, Soil science, Meteorology, Climatology.

The average annual soil moisture balance, as derived from the mechanics of storm and interstorm soil moisture movement and from the statistics of the climatic variables, was used to define the average annual soil moisture. This soil moisture was used in the equation for average annual yield to give a first-order approximation of the annual precipitation yeild function. This function was used to transform the cumulative distribution function (cdf) of annual precipitation into the cdf of annual yield, and application was made in a subhumid and in an arid climate. The derived yield frequency function was seen to be sensitive to the soil and vegetal properties. Proper selection of these parameters brings close agreement with observed streamflow-frequency and suggests the model's utility for parameterizing drainage basins with respect to effective average soil and vegetal properties. (See also W79-04037)(Sims-ISWS)
W79-04043

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 7C.
W79-04081

A UNIFIED APPROACH TO WATERSHED MODELLING,
Benin Univ. (Nigeria).
A. A. Afounda.
Nordic Hydrology, Vol. 9, No. 3/4, p 161-172, 1978. 1 fig, 19 ref.

Descriptors: *Watersheds(Basins), *Rainfall, *Runoff, *Model studies, Mathematical models, Equations, Flow, Overland flow, Groundwater movement, Unsaturated flow, Surface runoff, Rainfall-runoff relationships, Hydrology, Subsurface runoff, Watershed modelling.

This paper summarized the main points of a theoretical study of the general watershed behavior on the basis of the known deterministic physics-based approaches for overland flow, underground flow, and unsaturated medium physics. A parameter z(theta) which describes the soil water movement in the unsaturated zone and accounts for evaporation was introduced. Thus, a differential equation which allows a state-space formulation of the processes in the watershed was obtained, and the solution of the state equation can be given the form of the Volterra Integral series. The obtained results were compared with those of previous studies. (Sims-ISWS)
W79-04084

APPLICATION OF A VERSION OF THE STANFORD MODEL TO A SMALL PIEDMONT WATERSHED,
Clemson Univ., SC. Dept. of Agricultural Engineering.
J. T. Ligon, and A. G. Law.
Transactions of the ASAE American Society of Agricultural Engineers, Vol. 16, No. 2, p 261-265, 1973. 8 fig, 2 tab, 10 ref. OWRT A-010-SC(6).

Descriptors: *Simulation, *Model tests, *Streamflow, Peak runoff, Storm runoff, Surface runoff, Base flow, Flood hydrographs, *Stanford Model.

An evaluation of a version of the Stanford Watershed Model as applied to the Clemson Research Watershed is reported. Best-fit parameters for this watershed are presented. Examples of the agreement between observed and simulated streamflow for annual, monthly, daily, and individual storm periods are presented in tabular and graphical form. Important model parameters related to accurate prediction of streamflow for each period are listed and discussed. Very good predictions of annual streamflow and reasonably good predictions of monthly flow were obtained. Storm hydrographs were simulated less accurately. However, high flow frequencies for simulated and recorded flows were in acceptable agreement. (See also W72-06602)
W79-04086

FINITE ELEMENT SOLUTION OF SAINT-VENANT EQUATIONS,
Nevada Univ., Reno.
For primary bibliographic entry see Field 10D.
W79-04100

A STORAGE-ROUTING MODEL RELATING DRAINAGE BASIN HYDROLOGY AND GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-04222

A METHOD FOR PARAMETER SENSITIVITY ANALYSIS IN DIFFERENTIAL EQUATION MODELS,
Albany Medical Coll., NY. Div. of Computer Science.
For primary bibliographic entry see Field 6A.
W79-04229

TOPOLOGICAL CLASSIFICATIONS OF DRAINAGE NETWORKS: AN EVALUATION,
Indiana Univ., Bloomington. Dept. of Geography.
L. J. Onesti, and T. K. Miller.
Water Resources Research, Vol. 14, No. 1, p 144-148, February, 1978. 3 fig, 2 tab, 17 ref.

Descriptors: *Drainage, Channels, Geomorphology, *Networks, Classification, Basins, Correlation analysis.

Channel networks for 103 drainage basins ranging in size from 0.65 to 199 sq km were classified according to 9 topologic systems ranging from Strahler's order and Shreve's magnitude to those recently derived by Werner and Smart. Correlation coefficients and coefficients of determination were calculated to test the relationship between these systems and 10 characteristics of drainage basins and stream channels. The results suggest that (1) network properties are closely associated with basin area and with other characteristics primarily determined by area, (2) the hydraulic variables are essentially unrelated to all topologic systems analyzed, and (3) certain newly proposed topologic systems are unrelated to all characteristics tested, including area. (Skogerboe-Colorado State)
W79-04232

DESERTIFICATION OF THE GREAT PLAINS: WILL IT HAPPEN,
Clark Univ., Worcester, MA.
M. J. Bowden.
Economic Geography, Vol. 53, No. 4, p 397-406, Oct. 1977. 30 ref.

Descriptors: *Agroclimatology, *Arid lands, *Land management, *Desertification, *Droughts, Water management(Applied), Climatology, Water

shortage, Weather modification, Hydrologic budget, Land conservation, Farm management, Land reclamation, Arable land, Soil reclamation, Irrigation practices, Precipitation(Atmospheric), Great Plains, Forecasting.

The prospect of future desertification in the American Great Plains is considered under the headings of three central issues: (1) will climatic change take place, (2) will the region's soil and water resources be lost or depleted by the existing livelihood systems, and (3) will there be enough people willing to continue farming in the region. Consideration of Willett's solar-climatic hypothesis indicates that desertification of the Great Plains through purely physical causes in the next century is slight. Although other theories suggest regular, recurrent drought in the plains or climatic changes due to random frequency changes in the upper air patterns, it is probably safe to conclude that conditions in the plains in the next century are likely to be no worse than the last century in terms of precipitation effectiveness. Adaptation to the plains environment has proceeded rapidly, creating doubt that the levels of stress in the early drought periods will ever again be replicated or approached. Major features of this adaptation have been (1) an increase in farm size, (2) reduction in the number of farmers caused by farm consolidation, (3) major changes in crops and cropping practices, and (4) older, better educated and more persistent farmers. It is concluded that while some soil losses and reductions of irrigated land will occur, conditions will never again approach those of the 1930-1960 period. (Tickes-Arizona)
W79-04285

DESERTIFICATION OF ARID LANDS,
Texas Tech Univ., Lubbock.
H. E. Dregne.
Economic Geography, Vol. 53, No. 4, p 322-331, Oct. 1977. 6 fig, 1 tab, 6 ref.

Descriptors: *Desertification, *Mapping, *Distribution patterns, *Surveys, Areal mapping, Droughts, Environment, Atlas, Terrain analysis, Soil surveys, Climatic data, Evaluation, Hydrological data, Weather data, Classification, Arid lands.

Here desertification is defined as the impoverishment of arid, semiarid, and subhumid ecosystems by the combined impact of man's activities and drought. This authority concedes that very little reliable information is available on the extent of desertification in various countries, so the maps presented here, as a means of identification of the process, are based on a minimum of accurate data relating to vegetative changes, wind and water erosion, and soil salinization. The classification system devised calls for four levels of deterioration as criteria: slight, moderate, severe, and very severe. While only the extent of desertification is illustrated in these maps, and susceptibility has been evaluated subjectively in arriving at estimates of deterioration, the author urges their use within a framework of recognition that they are intended only as general guides in the assessment of the status of desertification in the world's arid regions. (Tickes-Arizona)
W79-04287

EARTH-ATMOSPHERE SYSTEMS AND SURFACE REFLECTIVITIES IN ARID REGIONS FROM LANDSAT MSS DATA,
Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences; and National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
J. Otterman, and R. S. Fraser.
Remote Sensing of Environment, Vol. 5, No. 4, p. 247-266, 1976. 10 fig, 5 tab, 26 ref.

Descriptors: *Albedo, *Reflectance, *Remote sensing, Radiation, Satellites(Artificial), Atmosphere, Turbidity, Water vapor meteorology, Atmospheric physics, Arid regions, Meteoric water.

Overgrazing, cultivation and other anthropogenic pressure have been reported as having a strong impact upon the surface albedo (reflectivity) of water stressed arid regions throughout the world. The purpose of this paper is to report the values of vertical reflectivity (albedo) from selected arid regions as measured by the Landsat multispectral scanner (MSS). Results of computed atmospheric transmission and scattering data are presented in terms of the ratio between earth-atmosphere system reflectivity and ground reflectivity for various solar elevation angles and atmospheric models. These ratios are then used to compute ground reflectivities from space nadir reflectivities assuming average atmospheric conditions. The ratios are presented as graphs for two water vapor levels and the effect of variation in atmospheric turbidity and water vapor content on the accuracy of albedo measurements is determined and assessed. The estimated albedo measurements are in the range of 0.34 - 0.52 higher than previously reported but are consistent with laboratory and in situ measurements. (Tickes-Arizona)
W79-04297

FLOODING IN THE DESERT - NATURE'S PARADOX,
D. Sagramoso.
Arizona Professional Engineer, Vol. 30, No. 7, p. 11, July, 1978. 2 fig.

Descriptors: *Flood control, *Flood protection, Dams, Drainage programs, Flood damage, Flood plains, Reservoir operation, Watershed management, Water distribution(Applied), Flood discharge, Peak discharge, Overland flow, Administrative agencies, Arizona.

Although flooding in the desert is a paradox to many there are several reasons for this occurence. The periodic floods in Maricopa County, which lies entirely within the Gila River watershed covering an area of 58,000 square miles or about one half the state of Arizona, is used here to illustrate the problem. Water from the Gila River and its tributaries flows into Maricopa County from three sides and funnels out via the western boundary of the county to the Colorado River at Yuma. Flooding dangers are precipitated by the rapid runoff from the mountains surrounding the greater Phoenix area, the relatively steep decline of the Salt River, the lack of percolation into the frozen ground at higher elevations, and snow melt of the Spring rains. State authorities have recognized these problems and created special flood control districts as municipal corporations and political subdivisions of the state. The operation and financing of the flood control district of Maricopa County is described. This district organization was organized in 1959 and remains today the only special flood control district in Arizona. (Tickes-Arizona)
W79-04300

PREDICTING LONGITUDINAL DISPERSION OF POLLUTANTS IN RIVERS,
Missouri Univ.- Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04365

MODELING DISSOLVED OXYGEN IN THE NEAR-FIELD,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04366

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

2B. Precipitation

CLIMATE, SOIL, AND VEGETATION--1. INTRODUCTION TO WATER BALANCE DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04037

CLIMATE, SOIL, AND VEGETATION--2. THE DISTRIBUTION OF ANNUAL PRECIPITATION DERIVED FROM OBSERVED STORM SEQUENCES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol 14, No 5, p 713-721, October 1978. 12 fig, 1 tab, 11 ref.

Descriptors: *Precipitation(Atmospheric), *Storms, *Frequency, *Temporal distribution, Statistics, Model studies, Mathematical models, Duration curves, Precipitation intensity, Rainfall intensity, Probability, Climatic data, Climatology, Meteorology.

Point precipitation was represented by Poisson arrivals of rectangular intensity pulses that have random depth and duration. By assuming the storm depths to be independent and identically gamma distributed, the cumulative distribution function for normalized annual precipitation was derived in terms of two parameters of the storm sequence, the mean number of storms per year, and the order of the gamma distribution. In comparison with long-term observations in a subhumid and an arid climate, it was demonstrated that when working with only 5 years of storm observations, this method tends to improve the estimate of the variance of the distribution of the normalized annual values over that obtained by conventional hydrologic methods which utilize only the observed annual totals. (See also W79-04037) (Sims-ISWS)
W79-04038

CLIMATE, SOIL, AND VEGETATION--6. DYNAMICS OF THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04042

CLIMATE, SOIL, AND VEGETATION--7. A DERIVED DISTRIBUTION OF ANNUAL WATER YIELD,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04043

RESERVOIR SEDIMENTATION AS A FUNCTION OF PRECIPITATION VARIABILITY,
Maryland Univ., Baltimore. Dept. of Geography.
For primary bibliographic entry see Field 4D.
W79-04061

USING SATELLITE IMAGERY TO DETECT AND ESTIMATE RAINFALL FROM FLASH-FLOOD PRODUCING THUNDERSTORMS,
National Environmental Satellite Service, Washington, DC. Applications Div.
R. A. Scofield.
In: Preprint Volume: Conference on Weather Forecasting and Analysis and Aviation Meteorology, Silver Spring, Maryland, October 16-19, 1978. American Meteorological Society, Boston, Massachusetts, 1978. p 132-141, 25 fig, 4 ref.

Descriptors: *Flash floods, *Remote sensing, *Satellites(Artificial), Floods, Rainfall, Thunderstorms, Excessive precipitation, Precipitation(Atmospheric), Radar, Rain gages, Infrared radiation, Isohyets, Data processing, Analytical techniques, Meteorology, *Satellite imagery.

The purpose of this paper was twofold: (1) to present the results of the Scofield/Oliver technique on four major flash flood producing rainstorms, and (2) to determine what signatures in the imagery were common to each of these rainstorms. The

flash flood producing rainstorms occurred in the following locations: Chicago, IL, June 13-14, 1976; Big Thompson Canyon, CO, July 31-August 1, 1976; Johnstown, PA, July 19-20, 1977; and Kansas City, MO, September 12-13, 1977. A procedure was described that uses the principles developed for point rainfall estimates but applied differently to give area rainfall. Satellite-derived area rainfall calculations were used in this study to detect and estimate rainfall from the four flash flood producing thunderstorms. The scheme successfully analyzed the heavy rainfall accumulation associated with each of the flashflood producing thunderstorms. Signatures in the imagery were common to each of the flash flood producing rainstorms. (Sims-ISWS)
W79-04072

A UNIFIED APPROACH TO WATERSHED MODELLING,
Benin Univ. (Nigeria).
For primary bibliographic entry see Field 2A.
W79-04084

SOME ERRORS IN PRECIPITATION MEASUREMENTS,
Aarhus Univ., (Denmark). Inst. of Geology.
K. R. Rasmussen, and C. Halgreen.
Nordic Hydrology, Vol. 9, No. 3/4, p 145-160, 1978. 7 fig, 3 tab, 14 ref.

Descriptors: *Precipitation(Atmospheric), *Measurement, *Rain gages, Equipment, Instrumentation, Winds, Evaporation, Sites, Adhesion, Condensation, Rainfall, Snowfall, Meteorology, *Error analysis, Measurement errors, Aerodynamics effects, Wind screens, Splash.

The effect of gauge height, exposure, and screening on systematic errors in rainfall estimation was investigated. Adhesion losses were found to be more than 2% of the annual precipitation, but for summer periods alone adhesion losses can amount to over 5%. A statistical model using the square root of observations (corrected for adhesion) was found to be adequate to describe difference due to the aerodynamic effects. A correction formula was proposed. (Sims-ISWS)
W79-04088

THE EFFECTS OF RAIN GAGE DENSITIES ON THE ANALYSIS OF STORM TOTAL RAINFALL FROM CONVECTIVE COMPLEXES,
Eddy (Amos), Inc., Norman, OK.
A. Eddy, and L. Hembree.
Final Report, September 1978. 82 p, 34 fig, 12 tab, 6 ref. 7-07-83-V007.

Descriptors: *Meteorology, *Rainfall, *Storm structure, Rainfall intensity, Rain gages, Distribution patterns, Storms, Instrumentation, Mathematical studies, Algorithms, Simulated rainfall, Radar, Remote sensing, Time lag.

The Eddy Statistical Objective Analysis, a system for determining rainstream characteristics and quantities was tested. The small scale capabilities of the analysis algorithm were tested in the analysis of a small storm, termed a 'worst case', and the analysis of a larger storm as a comparison. Total rainfall volume was obtained using radar reflectivities and rain gage data. Simulated rain gage data was used to test the system's sensitivity in detecting storm total rainfall through observations of the rainfall patterns produced by an analytical function termed the SIGNAL GENERATOR. It was found that rainfall gradients dictated the density requirements of the precipitation pattern. Simulated storms were analyzed from two sets of 400 storms each comprised of gage only observations. Between-storm discrimination techniques, and the use of the linear discriminant function to combine storm attributes are discussed. (Davison-IPA)
W79-04108

ESTIMATING PEAK DISCHARGES IN SMALL URBAN HAWAIIAN WATERSHEDS FOR SELECTED RAINFALL FREQUENCIES, KANE'OHE WATERSHED, O'AHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
N. C. Lopez, and G. L. Dugan.
Technical Memorandom No 58, August 1978. 24 p, 9 fig, 5 tab, 11 ref.

Descriptors: *Storm runoff, *Peak discharge, Small watersheds, Time of concentration, *Rainfall-runoff relationships, Urbanizaton, *Flooding, Flood forecasting, Hawaii.

The Hawaii Environmental Simulation Laboratory (HESL) has attempted to simulate some of the consequences of alternative land use-economic decisions. The Kane'ohe region on O'ahu Island, Hawaii was selected as a study area. Flooding, which has historically created hazard areas in Kane'ohe, appears to be significantly altered by the rapid urbanization of the region. The problem of predicting flooding patterns in the Kane'ohe region, as well as Hawaii in general, is complicated by the rather small area of the individual watersheds, the abrupt changes in terrain, and the short times of concentration, generaly less than 1 hr. Using existing technology, a planning-oriented tool for predicting peak discharges resulting from various patterns of urbanization has been developed for Hawaiian conditions. The tool utilizes the U.S. Soil Conservation Service Runoff Curves, a unique time of concentration formula, and the U.S. Weather Bureau Rainfall-Frequency Atlas of the Hawaiian Islands. Areas within the watershed were segregated by ranges of slope into response zones. Input data include soil class and cover, hydraulic length, and average slope. The model was applied to ten individual watersheds within the Kane'ohe region, and estimates of peak discharge for the watersheds were made for selected rainfall return intervals. Peak discharge values were determined for existing land use and for three different scenarios (hypothetical patterns of urban growth) for the year 1995. Tests of the model using the rather limited existing peak discharge records have been very encouraging.
W79-04126

PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, AN OVERVIEW OF THE SKYWATER IX CONFERENCE.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 030, Price codes: A10 in paper copy, A01 in microfiche. September 1977. 223 p, 10 fig, 6 Append.

Descriptors: *Environmental effects, *Weather modification, *Precipitation, *Induced precipitation, *Environmental control, *Cloud seeding, *Water resources management, Institutions, Erosion, Wildlife habitats, Sedimentation, Silver iodide, Vegetation effects, Colorado, *Alpine areas, Abiotic processes, Precipitation management.

The Skywater IX Conference was held in Vail, CO. in September 1977, to assess the present status of knowledge on possible environmental effects from widespread or prolonged application of the techniques of precipitation management that Project Skywater is developing, and to provide information for planning. The conference was organized into 6 workshops, each one presenting its own report. In the area of abiotic processes, precipitation management had the greatest effect on erosion and water yield and little effect on water quality and channel processes; alpine settings were considered the most sensitive to precipitation changes; erosion and mass wasting are leading issues for summer programs, and snow duration for winter programs. In the area of vegetation, effects in the High Plains come mostly from possible changes in land use and cultivation stemming from rain stimulation, whereas in alpine areas, snow duration would be the most important factor. Animal species selected as impact receptors by the workshop studying animals included pronghorns, affected by possible encouragement of encroaching civilization, and elk and mule deer, affected by possible influence on range conditions, especially winter range. Anticipated societal benefits of more crops and clean power face barriers because of inadequate information on ownership and the cost of water developed by precipitation augmentation, and the lack of appropriate institutions for carrying it on. Seeding agents like silver iodide were found to have no significant effects. The environmental overview noted concern for possible initiation of long-term trends, linkage with conservation activities, and information transfer in the context of a regional concept. (Coan-NC)
W79-04157

A RAINFALL SIMULATOR FOR FIELD STUDIES OF RUNOFF AND SOIL EROSION,
Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Agricultural Biochemistry and Soil Science,
I. T. Grierson, and J. M. Oades.
Journal of Agricultural Engineering Research, Vol. 22, No. 1, p 37-44, March, 1977. 6 fig, 3 tab, 14 ref.

Descriptors: *Simulated rainfall, *Surface runoff, *Runoff, *Rainfall-runoff relationships, *Simulation analysis, Rainfall intensity, Soil erosion, Infiltration.

Runoff and soil erosion, as indicative of the physical condition of soil surface layers, are important parameters, particularly in arid regions that have been studied through rainfall simulation. Described here is a mobile unit capable of simulating rainfall intensity, drop size and drop velocity within a range of natural rainfall over a test plot of one meter square. Similar to the device developed in Israel, this simulator includes nozzles and a segmented rotating disc to control rainfall intensity. Water is pumped from reservoirs to the nozzles and excess water from the rotating disc is confined and drained back to the reservoirs by a splash guard and roof canopy. Both the spray and circulating water assemblies are built into a unit mounted in a trailer for easy transportation. Detailed characteristics and field use of the simulator are described and graphically illustrated. (Tickes-Arizona)
W79-04289

THE DISASTROUS FLOOD OF '78,
J. A. Wise, Jr.
Arizona Professional Engineer, Vol. 30, No. 7, p 12-13, July 1978, 3 fig.

Descriptors: *Flood control, *Storm runoff, *Flood routing, *Channel improvement, Flash floods, Flood plains, Flow control, River basin development, Watershed management, Flood damage, Historic floods, Regional flood, Structural design, Structural analysis, Peak discharge, High flow, Salt River Basin, Arizona.

Storm events of early 1978, and the consequent flooding of the Salt River in the vicinity of Phoenix, Arizona, are described and illustrated. The storms analyzed here began February 27, 1978, deposited as much as 12.3 inches of rainfall over the next three days on the Verde and Tonto watersheds, and caused considerable damage to the major drainage areas of the Cave Creek and Verde-Salt River Basins. Because the lakes filled rapidly, the Salt River project was required to initiate and manage large releases of flood water into the Verde and Salt River systems. These releases, which reached peak of 115,000 cfs. at the Tempe Bridge, were reasonably well contained in the Salt River Bed but still caused extensive damage at most river crossings and at Sky Harbor Airport. Damage estimates and future structural plans to reduce the possibility of a repeat occurrence are described. (Tickes-Arizona)
W79-04299

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

2C. Snow, Ice, and Frost

THE EFFECT OF ICE COVER ON VERTICAL TRANFER IN STREAM CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W79-04062

2D. Evaporation and Transpiration

CLIMATE, SOIL, AND VEGETATION--4. THE EXPECTED VALUE OF ANNUAL EVAPOTRANSPIRATION,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 731-739, October 1978. 6 fig, 24 ref.

Descriptors: *Evapotranspiration, *Evaporation, *Model studies, Mathematical models, Soil moisture, Vegetation, Soils, Soil water, Soil water movement, Precipitation(Atmospheric), Transpiration, Drying, Annual, Equations, Soil science, Bare soils, Interstorm evapotranspiration.

The depth of interstorm evapotranspiration from natural surfaces was composed (by proportion of vegetal canopy density) of evaporation from bare soil and transpiration from vegetation. The former was obtained in terms of random variables describing initial soil moisture, time between storms, and potential rate of evapotranspiration from an exfiltration analogy to the Philip infiltration equation modified to incorporate moisture extraction by plant roots. The latter was assumed to occur at the potential rate for natural vegetal systems. In a zeroth-order approximation, the initial soil moisture was fixed at its climatic space and time average whereby using an exponential distribution of time between storms and a constant potential rate of evapotranspiration the expected value of interstorm evapotranspiration was derived. This mean value was used to obtain the annual average point evapotranspiration as a fraction of the potential value and as a function of dimensionless parameters defining the climate-soil-vegetation system. (See also W79-04037) (Sims-ISWS)
W79-04040

CESSATION OF RETURN FLOW AS A MEANS OF COMPLYING WITH POLLUTION CONTROL LAWS,
For primary bibliographic entry see Field 6E.
W79-04445

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

2E. Streamflow and Runoff

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04009

FLOOD FREQUENCY OF SMALL STREAMS IN ALABAMA,
Geological Survey, University, AL. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04024

FLOOD PROFILES FOR PEACE RIVER, SOUTH-CENTRAL FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
W. R. Murphy, Jr., K. M. Hammett, and C. V. Reeter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 589, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-57, 1978. 35 p, 6 fig, 6 tab, 18 ref.

Descriptors: *Floods, *Flood profiles, *Peak discharge, *Flood recurrence interval, *Backwater, Flood plains, Model studies, Analytical techniques, Regional flood, Forecasting, Evaluation, Florida, *Peace River, *South-central Florida, Polk County, Hardee County, DeSoto County.

This report presents flood heights and profiles for a 70-mile reach of Peace River from Bartow to Arcadia, Fla. The flood heights were calculated using the U.S. Geological Survey step-backwater model. Profiles were prepared for floods having expected recurrence intervals of 2, 2.33, 5, 10, 25, 50, 100, 200, and 500 years. Flood-peak discharges used in the step-backwater analyses were determined by weighting stream gaging-station data with data from a regional analysis. Land-surface elevation data for 183 cross sections - including values of Manning's roughness coefficient - also were used in the backwater analysis. Flood height data are generally accurate to + or - 0.5 foot. They indicate that most roads and two bridges in the study reach will be inundated by some of the floods evaluated. (Woodard-USGS)
W79-04027

CLIMATE, SOIL, AND VEGETATION--5. A DERIVED DISTRIBUTION OF STORM SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 741-748, October 1978. 6 fig, 2 tab, 11 ref.

Descriptors: *Runoff, *Surface runoff, *Model studies, Mathematical models, Storms, Storm runoff, Excessive precipitation, Precipitation(Atmospheric), Rainfall, Soils, Soil properties, Infiltration, Statistics, Probability, Temporal distribution, Floods, Flood frequency.

The Philip infiltration equation was integrated over the duration of a rainstorm of uniform intensity to give the depth of point surface runoff from such an event on a natural surface in terms of random variables defining the initial soil moisture, the rainfall intensity, and the storm duration. In a zeroth-order approximation, the initial soil moisture was fixed at its climatic space and time average; whereupon by using exponential probability density functions for storm intensity and duration, the probability density function of point storm rainfall excess was derived. This distribution was used to define the annual average depth of point surface runoff and to derive the flood volume frequency relation, both in terms of a set of physically meaningful climate-soil parameters. (See also W79-04037)(Sims-ISWS)
W79-04041

A MATHEMATICAL MODEL OF MONTHLY FLOW SEQUENCES,
Technical Univ. of Istanbul (Turkey).
Z. Sen.
Hydrological Sciences Bulletin, Vol. 23, No. 2, p 223-229, June 1978. 5 ref.

Descriptors: *Mathematical models, *Time series analysis, *Markov processes, *Model studies, *Theoretical analysis, Hydrology, Mathematical studies, Correlation analysis, Flow, Monthly, Flow sequences, Markov model, Thomas-Fiering model.

A general mathematical model for the generation of synthetic monthly flows was developed. The model preserves the means and standard deviations of monthly flow sequences and the lag-zero cross-correlation between successive months together with the first-order serial correlation of each month. Methodology was suggested for deriving the model parameters. It was shown that the conventional lag-one Markov model and the Thomas-Fiering model are special cases of the model presented. All of the necessary analytical expressions of the correlation structure of the model were derived. Fitting of the model to monthly flow data and the generation of synthetic sequences also were discussed. (Singh-ISWS)
W79-04054

THE EFFECT OF ICE COVER ON VERTICAL TRANFER IN STREAM CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
H. T. Shen, and T. O. Harden.
Water Resources Bulletin, Vol. 14, No. 6, p 1429-1439, December 1978. 6 fig, 1 tab, 22 ref.

Descriptors: *Ice cover, *Mixing, *Channels, *Model studies, Mathematical models, Rivers, Streams, Water pollution, Effluents, Sediments, Sediment transport, Mass transfer, Flow, Dispersion, Hydraulic, Simulation analysis, Ice cover effects.

The effect of ice cover on vertical transfer was examined based on the Reynolds analogy and composite logarithmic velocity distributions. A finite difference scheme was used to predict concentration profiles in a two-dimensional channel. Comparisons made between the ice-covered conditions and the ice-free condition showed that considerable reduction in mixing capacity of the channel is caused by the ice cover. (Sims-ISWS)
W79-04062

IDENTIFICATION AND SEPARATION OF MAJOR BASE FLOW COMPONENTS FROM A STREAM HYDROGRAPH,
Department of the Environment, Reading (England). Central Water Planning Unit.
A. B. Birtles.
Water Resources Research, Vol. 14, No. 5, p 791-803, October 1978. 7 fig, 2 tab, 29 ref.

Descriptors: *Base flow, *Hydrographs, *Model studies, Transpiration, Soil moisture, Aquifers, Recharge, Recession curves, Rivers, Streams, Flow, *Base flow separation, Stream hydrographs, River hydrographs, Lumped parameter hydrological models.

A method was given for the separation of the major base flow components in a river hydrograph using simple models. Simplifying assumptions were made which enable the models to be used without rainfall data if necessary, suitable information being deduced from the river hydrograph. Lumped parameter hydrological models were used for the calculations of actual transpiration, soil moisture deficit, and aquifer recharge rates. The base flow components were identified in terms of a recession time constant, an initial value, and an infiltration contribution. The techniques were applied to the River Severn, for which flow components were separated and then used to illustrate applications to a study of the behavior of conservative water quality determinants. (Lee-ISWS)
W79-04067

A UNIFIED APPROACH TO WATERSHED MODELLING,
Benin Univ. (Nigeria).
For primary bibliographic entry see Field 2A.
W79-04084

MUSKINGUM-CUNGE METHOD WITH VARIABLE PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. M. Ponce, and V. Yevjevich.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Technical Note, p 1663-1667, December 1978. 2 fig, 1 tab, 8 ref, 1 append.

Descriptors: *Flood routing, *Flood waves, *Mathematical models, Routing, Analytical techniques, Model studies, Channels, Discharge(Water), Flood flow, Hydrograph analysis, Muskingum-Cunge method.

The Muskingum method and its improved Muskingum-Cunge version are well established in the flood routing literature. The Muskingum method is based on the assumption of a linear relationship between the inflow, I, the outflow, O, and the reach storage, V, of the form V = K(XI +(1-X)0) in which K and X are the parameters. In the conventional Muskingum method, these parameters are determined by calibration using measured inflow and outflow hydrographs. On the other hand, in the Muskingum-Cunge version K and X are calculated using the formulas derived by Cunge. The experience with the Muskingum-Cunge version was reported. It was shown that the way of calculating the parameters has a definite bearing on the overall accuracy of the method. The assumption of constant parameters makes the solution dependent on the reference values chosen to evaluate the parameters. A more physically realistic approach is to consider the parameters K and X to vary in time and space according to the flow variability. A three-point approach and an iterative four-point approach to the calculation of the variable parameters were shown to be sufficiently accurate in the simulation of flood flows. A two-point approach was shown to be inaccurate in the calculation of peak discharge and travel time. Furthermore, the two-point method results in a significant loss of mass. (See also W70-04590)(Humphreys-ISWS)
W79-04122

FLOOD PLAIN INFORMATION: BUXTON CREEK AND TRIBUTARIES, DEQUINCY, LOUISIANA.
Army Engineer District, New Orleans, LA.
Prepared for the City of DeQuincy, LA, October 1972, 29 p, 22 fig, 23 plates, 6 tab.

Descriptors: *Louisiana, *Flooding, *Flood profiles, *Buxton Creek(LA), *DeQuincy(LA), *Peak discharge, Floods, Indirect flood measurement, Historic floods, Flood data, Flood recurrence interval, Flood stages, Flood peak, Flow duration, Stage-discharge relations, Flood protection, Nonstructural alternatives, Warning systems, Control structures, Channel improvement, Standard Project Flood, Intermediate Regional Flood.

The study area is the city of DeQuincy, Louisiana located in the flood plain of Buxton Creek. Buxton Creek has a total drainage area of 63.6 square miles and is a major tributary of the Houston River. The flood plain of Buxton Creek is developed primarily for residential use. All developments in the flood plain, including railroads, highways, streets, public utilities, residences, commercial buildings, and the sewage treatment plant, are subject to flood damage. Flood data were gathered from field surveys, National Weather Service precipitation gages, historical records, and newspaper files. Major floods occur during the summer and fall seasons, resulting primarily from hurricanes and heavy rainfall. The only flood damage reduction measures are two channel improvement projects, completed in 1958, but no maintenance has been done on them since that time. There are no existing zoning ordinances, building codes, or other regulatory measures specifically for the reduction of flood damages. The highest flood of record on Buxton Creek occurred on October 27, 1970, but no streamflow records exist. The Intermediate Regional Flood on Buxton Creek, at Louisiana Highway 27, is forecasted to have a peak discharge of 6,490 cubic feet per second (cfs) and rise to an elevation of 60.3 feet above mean sea level (msl). At the same site, the Standard Project Flood discharge would be 11,500 cfs with a height of 62.3 feet msl. The duration above bankfull stage for the Intermediate Regional Flood would be 14 hours, and for the Standard Project Flood, 21 hours. This report is intended as an aid in the identification of flood damage reduction techniques, both structural and non-structural, and is intended to be used as the basis of a flood plain management program for DeQuincy. (Coan-NC)
W79-04150

FLOOD PLAIN INFORMATION: SIXMILE CREEK--VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
Prepared for the City and County of Pueblo, CO, April 1976. 28 p, 4 fig, 12 plates, 4 tab.

Descriptors: *Colorado, *Sixmile Creek(CO), *Pueblo(CO), *Flood plain management, *Flood protection, *Non-structural alternatives, *Building codes, *Zoning, *Flooding, Floods, Indirect flood measurement, Flood forecasting, Flood profiles, Flood stages, Peak discharge, Flood peak, Stage-discharge relations, Rivers, Floodways, Flood plain zoning, Warning systems, Land use, Planning, Floodproofing, Arkansas River(NM), Standard project flood, Intermediate regional flood.

The study area is the flood plain of Sixmile Creek, a tributary to the Arkansas River, in the vicinity of Pueblo, Colorado. Other than five bridge crossings, there has been very little development in the flood plain; land use is primarily agricultural. There are no streamgage or discharge records available for Sixmile Creek. Information on the larger aspect of flooding on the Arkansas River was obtained from newspaper files, historical records, and field investigations. Most of the flood-producing storms in the area occur from May through August, resulting from water, moist air from the Gulf of Mexico combining with cold, dry Polar air to produce thunderstorms. The area is also prone to cloudburst-type storms. In the Sixmile Creek basin, there is very little in the way of natural or man-made obstructions. Storm warnings are conducted under the auspices of the Pueblo Civil Defense Agency. The Intermediate Regional Flood and Standard Project Flood are predicted to have peak discharges of 19,379 cubic feet per second (cfs) and 35,655 cfs, respectively. This report is intended to provide information to aid in planning the best use of flood-prone lands and to serve as a tool for flood plain management. Guidelines for flood plain management are presented, with a variety of non-structural alternatives discussed. (Coan-NC)
W79-04151

RECORD FLOODS IN SOUTHWEST VIRGINIA, APRIL 1977.
Virginia State Water Control Board, Richmond; and Virginia Office of Emergency Services, Richmond.
Information Bulletin 527, June 1977, 46 p, 3 tab, 29 plates.

Descriptors: *Floods, *Flash floods, *Flood damage, *Flood flow, *Regional flood, *Flood data, *Flood stages, *Maximum probable flood, Flood plain insurance, Virginia, Flood protection, Flood proofing, Storms.

The April 2-5, 1977 rains brought the worst flooding in history to the ten Southwest Virginia counties of Buchanan, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, and Washington. Flooding occurs from the Powell, Clinch, and Guest Rivers, and Levisa Fork, Russell Fork, and Middle Fork. This report assesses the damages and concludes that this area of the state is particularly vulnerable to flooding. Damages were extensive, both to residential structures, with nearly 5,000 homes damaged or destroyed, and to public facilities and agricultural lands. Damages to buildings exceeded $101 million, and the combined damage to wastewater and water treatment plants exceeded $1 million. Recommendations include: elevation of all new structures above the 100-year flood plain and flood-proofing of existing buildings to at least the 100-year flood level; management of flood plains under the new 1977 Virginia Flood Damage Reduction Act, including assistance to political subdivisions and inspections by the State Water Control Board to evaluate enforcement of and compliance with local flood plain management regulations; governmental assistance to citizens in locating their residences; compliance with the provisions of the National Flood Insurance Program; and the need for a significant public relations campaign to alert residents to the dangers of flooding. (Arnold-NC)
W79-04153

UNIT SEDIMENT GRAPH,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W79-04172

A STORAGE-ROUTING MODEL RELATING DRAINAGE BASIN HYDROLOGY AND GEOMORPHOLOGY,
Wollongong Univ. (Australia). Dept. of Civil Engineering.
M. J. Boyd.
Water Resources Research, Vol. 14, No. 5, p 921-928, October 1978. 6 fig, 7 tab, 35 ref.

Descriptors: *Geomorphology, *Model studies, *Hydrology, *Watersheds(Basins), Networks, Drainage areas, Storage, Routing, Drainage, Time lag, *Storage routing models, Stream order, Network magnitude.

A study of four nested drainage basins was used to measure relations between lag time, stream order, and network magnitude for basins within a larger watershed. Solution of the stream order laws produced a relation between lag time and drainage area which had the same form as the relations developed between different watersheds. A relation between lag time and drainage area was used to allocate storage parameters to the elements of a storage-routing model based on the stream channel network. When it was applied to the most probable stream networks for a given channel magnitude, the model was shown to reproduce relations between lag time and stream order, channel magnitude, and drainage area, having the same form as was observed for the actual drainage basins used in the study. (Lee-ISWS)
W79-04222

HYDRAULIC RESTORATION OF STREAM GRAVEL FOR SPAWNING AND REARING OF SALMON SPECIES,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8I.
W79-04260

AQUATIC ENVIRONMENTAL ANALYSIS IN THE LOWER YELLOW-STONE RIVER,
Montana Fish and Game Dept., Helena. Ecological Services Div.
For primary bibliographic entry see Field 6G.
W79-04276

A RAINFALL SIMULATOR FOR FIELD STUDIES OF RUNOFF AND SOIL EROSION,
Waite Agricultural Research Inst., Glen Osmond (Australia). Dept. of Agricultural Biochemistry and Soil Science,
For primary bibliographic entry see Field 2B.
W79-04289

SALT PICKUP BY OVERLAND FLOW IN THE PRICE RIVER BASIN, UTAH,
Colorado State Univ., Fort Collins; and Utah State Univ., Logan.
S. L. Ponce, and R. H. Hawkins.
Water Resources Bulletin, Vol. 14, No. 5, p 1187-1200, October, 1978. 5 fig, 2 tab, 10 ref.

Descriptors: *Saline water, *Water pollution sources, *Channel flow, *Shales, *Overland flow, Analytical techniques, Salts, River basins, Tributaries, Utah, Runoff, Water management(Applied).

Described is a field investigation of diffuse source contributions in the Price River Basin, east-central Utah, to determine the processes involving salt pickup associated with overland flow. Results obtained were used in the development of a nonpoint source loading function to predict salt production from diffuse sources as a function of overland flow from the Mancos shale lands of the Price River Basin. Data exhibited a high degree of natural variation which precluded the separation of factors affecting salt loading; however, a simplistic nonpoint loading function was developed on empirical concepts and fitted to the data. Application of this function revealed that even under severe conditions, the average annual salt yield to the Price River from overland flow was relatively minor. Nevertheless, attention is called to the fact that these results pertain only to salt concentration of runoff water prior to entering rills and other small micro-channels. As the water mass moved downstream, minute-size shale particles continue dissolving and thus release more salt to the runoff. Recommendations include management practices directed at retaining water on the site, including contour furrowing, chaining, or development of check ponds to deter channel erosion. (Tickes-Arizona)
W79-04298

DETERMINATION OF FLOOD LEVELS ON THE PACIFIC NORTHWEST COAST FOR FEDERAL INSURANCE STUDIES,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 2L.
W79-04359

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
For primary bibliographic entry see Field 8B.
W79-04372

MODIFICATION OF THE CHEZY ROUGHNESS COEFFICIENT BY DENSITY STRATIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
For primary bibliographic entry see Field 8B.
W79-04373

DYNAMIC STREAMFLOW-TEMPERATURE SIMULATION APPLIED TO THE BRAZOS-LITTLE RIVERS, TEXAS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W79-04379

CROSS-SECTION DATA FOR SELECTED PUERTO RICO STREAMS,
Geological Survey, San Juan, PR. Water Resources Div.
E. Colon-Dieppa, and R. Gonzalez.
Geological Survey open-file report 78-882, August 1978. 155 p, 30 fig.

Descriptors: *Floods, *Flood plain zoning, *Flood plain insurance, *Channel morphology, *Puerto Rico, *Cross-sections, *Streams, Flood plains, Planning.

The data presented are for delineating the inundation which could be expected by floods of selected magnitudes in Puerto Rico. These cross section data can be used in Flood Insurance Administration studies and in other studies related to the planning, development, and management of flood plains. The data were collected by the Caribbean District of the Water Resources Division of the U.S. Geological Survey in cooperation with the Puerto Rico Department of Natural Resources. (Woodard-USGS)
W79-04390

DATA FOR FLOODS OF MAY 1978 NORTHEASTERN WYOMING AND SOUTHEASTERN MONTANA,
Geological Survey, Helena, MT. Water Resources Div., and Geological Survey, Cheyenne, WY. Water Resources Div.
C. Parrett, D. D. Carlson, G. S. Graig, Jr, and J. A. Hull.
Geological Survey open-file report 78-985, November 1978. 16 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Floods, *Montana, *Wyoming, *Flood data, *Peak discharge, Flood frequency, Flood damage, Aerial photography, Hydrographs, Flood stages.

Severe flooding in northeastern Wyoming and southeastern Montana in May 1978 is described by tables of data, graphs, and photographs. Flood peaks were determined at 162 sites in the flooded area. At most of the sites, peak discharges were determined from existing stage-discharge relationship curves, and at 30 of the sites indirect flow measurements were made. At 19 sites, the May 1978 peak discharge exceeded the previous peak of record and also exceeded the computed 100-year frequency flood. (Woodard-USGS)
W79-04396

FLOODS OF SEPTEMBER 1970 IN ARIZONA, UTAH, COLORADO, AND NEW MEXICO,
Geological Survey, Tucson, AZ. Water Resources Div., and Geological Survey, Cheyenne, WY. Water Resources Div.
R. H. Roeske, M. E. Cooley, and B. N. Aldridge.
Available from Supt. of Documents, GPO, Washington, DC 20402, Price, $3.75. Geological Survey Water-Supply Paper 2052, 1978. 135 p, 13 fig, 1 plate, 6 tab, 19 ref.

Descriptors: *Floods, *Flood damage, *Rainfall intensity, *Streamflow, *Peak discharge, Storms, River basins, Arizona, Utah, Colorado, New Mexico, *Four Corners area, Pacific storm Norma(1970), Salt River basin, Verde River basin, Dolo River basin, San Juan River basin.

During September 5-7, 1970, unusually large floods occurred in the mountains of central Arizona and in the Four Corners area of Arizona, Utah, Colorado, and New Mexico. Flooding also occurred in southern and northeastern Arizona. The record-high rainfall of September 5 occurred when a mass of moist tropical air from Pacific storm Norma collided with a cold front from the Northwest. The flood took the lives of 23 persons and was reported to have caused about $8.4 million in damages in Arizona. The main area of flooding was in the mountains in central Arizona. The flood generally was less destructive with increasing distance downstream; in the Salt and Verde River basins the reservoirs were capable of storing all the floodwater. Flooding in the Dolores and San Juan River basins in the Four Corners area was mostly in rural areas, and two people were drowned in McElmo Creek in Utah. The flood was not as large as that of October 1911, which is the largest known flood in the area. A second storm occurred in the Four Corners area September 12-14; however, the amount of flooding generally was less than that from the previous storm. Flood damage as a result of the two storms was reported to be about $2.9 million. (Woodard-USGS)
W79-04402

FLOODS OF JULY 19-20, 1977, IN THE JOHNSTOWN AREA, WESTERN PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
S. A. Brua.
Geological Survey open-file report 78-963, July 1978. 62 p, 16 fig, 4 tab, 9 ref, append.

Descriptors: *Floods, *Pennsylvania, *Peak discharge, *Flood damage, *Dam failure, Streamflow, Storms, Flood frequency, Flood recurrence interval, Historic floods, Flood control, Flood plains, *Conemaugh River, Johnstown, Western Pennsylvania.

Intense rainfall on the evening of July 19 and early morning hours of July 20, 1977, resulted in moderate to record flooding throughout much of an eight-county area of southwest Pennsylvania. In a 400-square-mile area directly north and east of Johnstown, rainfall totals of 6 to 12 inches were measured in a six to eight-hour period. Flood peaks having recurrence intervals greater than 100 years were recorded at several sites, primarily in the Conemaugh River basin. Runoff rates were as high as 2,390 cubic feet per second per square mile, in a 5.86-square-mile drainage area in the Little Conemaugh River basin. The Conemaugh River at Seward, which drains 715 square miles, had a peak discharge of 161 cubic feet per second per square mile. The flood waters claimed at least 78 lives and caused total losses in excess of $300 million. Also, seven earthfill dams, used mainly for water supply in the Johnstown area, failed. This report describes the storm and the associated flooding. A tabulation of peak gage heights and discharges for the July 1977 flood and for the maximum flood previously known is included for 57 sites. Data pertaining to the dams that failed are included also. (Woodard-USGS)
W79-04413

APPROPRIATION FOR INSTREAM FLOW MAINTENANCE: A PROGRESS REPORT ON 'NEW' PUBLIC WESTERN WATER RIGHTS,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 6E.
W79-04438

2F. Groundwater

EXTERNAL COSTS OF LAND SUBSIDENCE IN THE HOUSTON-BAYTOWN AREA,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
J. P. Warren, L. L. Jones, R. D. Lacewell, and W. L. Griffen.
American Journal of Agricultural Economics, Vol. 57, No. 3, p 450-455, August 1975. 2 tab, 9 ref. OWRT A-023-TEX(1).

Descriptors: *Land subsidence, *Groundwater, *Houston-Baytown, *Texas, Aquifer management, Surface waters, Water supply, Water loss, Cost comparisons, Associated costs, Water rates, Cost analysis, Surveys, Groundwater recharge.

Land subsidence along the Texas coast is caused by the withdrawal of groundwater from underground aquifers in excess of natural recharge. A survey of businesses, residences, and public officials was used to estimate the costs of property damage and loss due to land subsidence. The estimated annual subsidence-related costs and losses of $14.6 million were used to evaluate the total costs of supplying water needs to the Houston-Baytown area from two alternative sources. The purchase of all the area's water needs would be justified according to a break-even analysis based on estimated annual subsidence-related costs and current water prices. A higher direct cost to users would result from substituting surface water for groundwater. (Davison-IPA)
W79-04015

HYDROLOGIC EVALUATION OF PART OF CENTRAL VOLUSIA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W79-04030

WATER RESOURCES OF CAMAS PRAIRIE, SOUTH-CENTRAL IDAHO,
Geological Survey, Boise, ID. Water Resources Div.
H. W. Young.
Geological Survey Water-Resources Investigations 78-82 (open-file report), 1978. 34 p.

Descriptors: *Groundwater resources, *Pumping, *Water level fluctuations, *Irrigation effects,

*Water quality, Groundwater recharge, Surface-groundwater relationships, Water supply, Water yield, Water utilization, Confined water, Water table aquifers, Idaho, *Camas Prairie.

Ground-water pumpage in Camas Prairie, Idaho, for irrigation and municipal supplies totaled nearly 9,500 acre-feet in 1977. Declines of pressure head in the artesian aquifer have ranged from 3 to 12 feet since 1974 when increased ground-water pumping began. A comparison of water-level measurements made in September 1957 and September 1977 shows declines of more than 30 feet in places in the artesian aquifer. Camas Prairie aquifers are recharged by percolation from streams and by precipitation on the valley floor. Estimated mean annual recharge to the artesian aquifer is 37,000 acre-feet. Vertical recharge from the artesian aquifer to the overlying water-table aquifer is estimated to be 20,000 acre-feet annually. Declines in artesian pressure caused by increased irrigation pumping will result in a reduction of recharge from the artesian aquifer to the water-table aquifer. Yields from irrigation wells in the prairie ranged from 400 to slightly more than 2,000 gallons per minute. Flows in Camas Creek in the 1977 drought year averaged 9,400 acre-feet, compared with 138,000 acre-feet in a normal year. Surface and ground waters sampled in the basin were either a sodium or calcium bicarbonate type water. Dissolved-solids concentrations ranged from 61 to 284 milligrams per liter. (Woodard-USGS)
W79-04031

HYDROGEOLOGY RELATED TO GEOTHERMAL CONDITIONS OF THE FLORIDAN PLATEAU,
Geological Survey, Woods Hole, MA. Water Resources Div., Alabama Univ., Tuscaloosa; and Coastal Petroleum Co., Tallahassee, FL.
F. A. Kohout, H. R. Henry, and J. E. Banks.
Florida Bureau of Geology Special Publication No. 21, p 1-41, 1977. 21 fig, 1 tab, 69 ref.

Descriptors: *Geothermal studies, *Florida, *Injection wells, *Groundwater movement, *Saline water intrusion, Water quality, Aquifers, Water temperature, Data collections, Model studies, Isotherms, Hydrogeology, Saline water-freshwater interfaces, Hot springs, Waste disposal, Gulf of Mexico, *Floridan Plateau, Florida Straits, Floridan aquifer system, Biscayne aquifer, Oil exploratory wells.

Temperature surveys in oil exploratory and waste-injection wells indicate that geothermal gradients underlying the Floridan Plateau are affected by the presence of cold sea water in the adjacent deeps of the Gulf of Mexico and the Florida Straits. The geothermal gradient is negative (the ground water becomes colder) to a depth of about 3,000 feet near the edge of the Plateau. In the horizontal direction, the temperature increases toward the central axis of the Plateau. The horizontal and vertical temperature distributions suggest that cold, dense sea water flows inland through the cavernous dolomite in the deep part of the aquifer where it becomes progressively warmed by geothermal heat flow. The reduction of density produces upward convective circulation. After mixing with fresh water in the upper part of the aquifer, the diluted salt water flows seaward to discharge by upward leakage through confining beds or through submarine springs on the Continental Shelf. The focal point for the deep sea-water flow, and the hottest water, should occur along the central axis of the Floridan Plateau, farthest from the cold sea-water bodies. Upwelling of warm saline water at Warm Mineral Springs sinkhole and the Mud Hole submarine spring near the west coast of Florida provides field evidence that a convective flow cell exists. Mathematical and laboratory model studies demonstrate a remarkable similarity to the patterns of salinity and temperature observed in the field. (Woodard-USGS)
W79-04033

PALEOHYDROLOGY AND MIGRATION OF THE GROUND-WATER DIVIDE IN REGIONS OF TECTONIC INSTABILITY IN ISRAEL,
Geological Survey of Israel, Jerusalem.
U. Kafri, and A. Arad.
Geological Society of America Bulletin, Vol. 89, No. 12, p 1723-1732, December 1978. 9 fig, 1 tab, 34 ref.

Descriptors: *Paleohydrology, *Water table, *Groundwater basins, *Geologic control, *Hydraulic gradient, Sea level, Valleys, Carbonate rocks, Aquifers, Karst, Groundwater recharge, Hydraulic conductivity, *Groundwater divide, *Israel, *Tectonic instability, *Mediterranean Sea, Base level, Structural control.

The Upper Cretaceous Judea carbonate-rock aquifer is situated between the base levels of the Mediterranean Sea in the west and the Jordan rift valley in the east, which have a maximum elevation difference of 400 m. The gradients of the groundwater table vary from very steep (8%) to very moderate (0.04%). The present groundwater divide in the uplifted central Israeli mountains coincides with the north-south structural axis. The divide in the Yizre'el and Beer Sheva morphotectonic valleys, which cut across these mountains, is located very close to the Mediterranean base level. It can be shown, theoretically, that the later subsidence of the rift valley relative to the Mediterranean should have caused a westward shift and a simultaneous lowering of the groundwater divide, as the eastern gradients became more gentle. This is the case in the Yizre'el and Beer Sheva valleys. Although structural control appears to be dominant in the study area, it is recognized that the location of the divide is controlled also by nonuniformity of recharge and hydraulic conductivities. Some of the present water tables have a past history as parts of the paleo-groundwater systems. These are identified on the basis of fossil karst systems and gentle gradients leading to ancient base levels, indicated by nearshore marine or lacustrine sediments. (Visocky-ISWS)
W79-04055

GROUND WATER OF THE ISLAND OF MONTREAL, CANADA,
McGill Univ., Montreal (Quebec). Dept. of Geological Sciences.
R. H. Grice, and M. D. Eggboro.
Water Resources Bulletin, Vol. 14, No. 6, p 1466-1480, December 1978. 8 fig, 4 tab, 19 ref.

Descriptors: *Groundwater, *Water chemistry, *Geology, *Canada, Groundwater movement, Recharge, Groundwater recharge, Natural recharge, Sampling, Data processing, Hydrogeology, Aquifers, Wells, Ions, Cations, Anions, Chemicals, Carbonate rocks, Igneous rocks, Faults(Geologic), *Montreal Island(Quebec).

The geochemistry and nature of the flow of groundwater not only control the supply potential, but also constitute clues to the whole geology of an area. A study was made of the largest available assemblages of data from 161 wells for the Island of Montreal. The data were collected by the Geological Survey of Canada in 1951-53. Data indicated that the system is generally subartesian, flowing from the principal topographically high areas towards the shores of the Island. As the probable use is about 13% of the estimated recharge of 140 million liters per day, most wells could be supplied by local recharge. The study confirmed the predominance of calcium bicarbonate groundwater from the carbonate sequence. The waters appeared to be saturated with respect to CaCO3 in all but 10 wells. The presence of other types of waters suggests the effects of the igneous intrusions of the area, the post-glacial marine submergence, and the upward movement of waters from deep sources through fault and other structural zones. Confirmation of the significant variations in chemical composition in some neighboring wells indicated the future need for repetitive sampling from specific horizons for chemical and isotopic analyses. (Sims-ISWS)
W79-04060

RADIUM-226 IN GROUND WATER OF WEST CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
For primary bibliographic entry see Field 5B.
W79-04065

GRAVITY-INDUCED CROSS-FORMATIONAL FLOW OF FORMATION FLUIDS, RED EARTH REGION, ALBERTA, CANADA: ANALYSIS, PATTERNS, AND EVOLUTION,
Alberta Research Council, Edmonton. Groundwater Div.
J. Toth.
Water Resources Research, Vol 14, No 5, p 805-843, October 1978. 42 fig, 3 tab, 40 ref.

Descriptors: *Groundwater movement, *Groundwater flow, *Gravity, *Canada, Potentiometric level, Water table, Water levels, Depth, Hydrostatic pressure, Hypsometric analysi, Equations, Diffusion, Hydraulic systems, Aquifers, Graphical analysis, Steady flow, *Alberta(Canada), Half-life, Gravity flow, Flow systems, Cross-formational flow.

Three zones of different generations of formation-fluid flow systems were identified from analyses of the potentiometric surface, hypsographic distribution of freshwater heads, pressure-depth relations, water table elevations, and dynamic pressure increments observed in 5 extensive water-bearing units in a 20,400 sq mi geologically mature area in northern Alberta. In each zone, fluids move in gravity-induced flow systems maintained by cross-formational energy transfer and subject to past or present boundary conditions. The force fields and associated flow systems in the basal zone of Middle Devonian aquifers were generated by and adjusted to the topography of the Pliocene continental surface. However, subsequent to the erosional exposure of the sub-Cretaceous unconformity about Pleistocene times, the drainage of the middle zone disrupted the supply of energy from the land surface to the Pliocene flow systems and changed them into slowly decaying relicts of regional fluid dynamics tending toward hydrostatic equilibrium. Solution of the diffusion equation for transient fluid potentials suggests a half-life time of approximately 0.7 m.y. for the excess hydraulic heads in the basal zone, indicating pre-Pleistocene origin for the observed flow distributions in that zone and thus supporting conclusions derived from the steady-state patterns of formation-fluid pressures. (Visocky-ISWS)
W79-04066

IDENTIFICATION AND SEPARATION OF MAJOR BASE FLOW COMPONENTS FROM A STREAM HYDROGRAPH,
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 2E.
W79-04067

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-04068

DETERMINATION OF AQUIFER DIFFUSIVITY FROM ANNUAL FLUCTUATIONS OF GROUND WATER LEVELS,
Technical Univ. of Denmark, Lyngby. Inst. of Hydrodynamics and Hydraulic Engineering.
K. Ambo.
Nordic Hydrology, Vol. 9, No. 3/4, p 187-196, 1978. 7 fig, 5 ref.

Descriptors: *Groundwater, *Water levels, *Diffusivity, *Model studies, Mathematical models, Fluctuations, Water level fluctuations, Aquifers, Wells, Water wells, Drawdown, Infiltration, Recharge, Natural recharge, Piezometry, Permeability, Hydrology.

Annual fluctuations of groundwater levels of an aquifer were described as a consequence of water recharging periodically over a part of the aquifer.

These areas can be depicted by drawing maps showing the areal amplitude distribution of the oscillation. Considering these areas as periodic (in time) surface sources, the damping and the phase of the oscillation were found analytically as functions of distance, the recharge areas being an infinite strip or a circular disc. From these solutions, the aquifer diffusivity can be calculated by the use of typecurves. (Sims-ISWS)
W79-04069

A FINITE ELEMENT AQUIFER MODEL WHICH TAKES INTO ACCOUNT ELEVATION CHANGES OF THE AQUIFER,
Helsinki Univ. of Technology, Otaniemi (Finland). Dept. of Civil Engineering.
J. Aalto.
Nordic Hydrology, Vol. 9, No. 3/4, p 173-186, 1978. 13 fig, 10 ref.

Descriptors: *Aquifers, *Drawdown, *Water levels, *Model studies, Mathematical models, Finite element analysis, Groundwater, Groundwater movement, Computer models, On-site investigations, Pumping, Wells, Water wells, Water table, Analytical techniques.

A finite element formulation, which takes into account elevation changes, was presented for confined aquifer flow. The middle surface of the aquifer was assumed not as a horizontal plane but as a curved surface. The theory of isoparametric finite elements was applied to develop a general isoparametric surface element for the problem. The presented technique, with little additional programming effort, can be incorporated into any standard finite element computer program for solving the two-dimensional, quasi-harmonic differential equaton (i.e., equation governing heat conduction, electric potential, and seepage through porous media, etc.). A computer program using a four node quadrilateral surface element was developed. Some results of two examples analyzed using this program were established. (Sims-ISWS)
W79-04083

HYDRAULIC AND ELECTRO-OSMOTIC PERMEABILITY COEFFICIENTS,
Wisconsin Univ. Milwaukee. Dept. of Civil Engineering.
P. N. Sundaram.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 105, No. GT1, Technical Note, p 89-92, January 1979. 2 fig, 5 ref, 2 append.

Descriptors: *Electro-osmosis, *Permeability, *Soil properties, *Porous media, Hydraulic conductivity, Measurement, Testing procedures, Analytical techniques, Laboratory tests.

A knowledge of hydraulic and electro-osmotic permeability coefficients is required to assess the amount and time rate of consolidation by electro-osmosis. Usually, the coefficients are determined separately. In one method, the pore water is allowed to rise in a vertical tube at the open cathode under a constant voltage gradient. The final electro-osmotic equilibrium head at the cathode is used to estimate the electro-osmotic permeability from a knowledge of the hydraulic permeability coefficient. An approximate method of estimating both the hydraulic and electro-osmotic permeability coefficients from the water rise versus time readings in one-dimensional flow test under constant voltage gradient was presented. With this method, it is also possible to estimate the final electro-osmotic equilibrium head, without prolonging the test for many days. (Humphreys-ISWS)
W79-04092

AN ITERATIVE QUASI-THREE-DIMENSIONAL FINITE ELEMENT MODEL FOR HETEROGENEOUS MULTIAQUIFER SYSTEMS,
Waterloo Univ. (Ontario).
D. W. Chorley, and E. O. Frind.
Water Resources Research, Vol. 14, No. 5, p 943-952, October 1978. 11 fig, 2 tab, 27 ref, 1 append.

Descriptors: *Aquifers, *Aquifer systems, *Aquitards, *Model studies, Mathematical models, Finite element analysis, Equations, Groundwater, Wells, Water wells, Groundwater movement, Hydraulic properties, Analytical techniques, Hydrology, Aquitard leakage.

A quasi-three-dimensional flow model was developed for the analysis of hydrogeologic systems consisting of several aquifers interconnected by aquitards. Provided only that each layer is continuous within the domain and that a permeability contrast of 2 orders of magnitude or more exists between adjoining layers, a system can be completely hetergeneous. Also, any of the aquifers can be pumped, and discharge rates can be arbitrary. Flexibility was achieved by utilizing finite element discretizations for aquifers as well as aquitards. The solution is iterative, aquifers and aquitards being solved separately and coupling being provided through the leakage flux. Aquitard storage and interaction between aquifers are rigorously accounted for at all times. Convergence was demonstrated experimentally by comparison with the analytial solution of Neuman and Witherspoon. The multiaquifer model was shown to be much more economical than an equivalent three-dimensional model. (Sims-ISWS)
W79-04125

A NOTE ON PACKER, SLUG, AND RECOVERY TESTS IN UNCONFINED AQUIFERS,
Tel Aviv Univ. (Israel). School of Engineering.
G. Dagan.
Water Resources Research, Vol. 14, No. 5, p 929-934, October 1978. 3 fig, 1 tab, 4 ref.

Descriptors: *Wells, *Testing, *Aquifers, Water wells, Numerical analysis, Computer programs, Mathematical models, Model studies, Hydraulic conductivity, Permeability, Groundwater, Water table, Hydrology, Recovery tests, Packer tests, Slug tests.

Packer, slug, and recovery tests are common procedures for determining the hyrdaulic conductivity of unconfined formations of low permeability. The volumes of water injected or removed from the borehole are small, so that the water table remains horizontal and the flow is steady. The flow problem by source distributions along the well axis. A simple numerical method and numerical results covering a wide range of the parameters of the problem were presented. The main limitation of the method is the requirement that the active portion of the well length should be much larger (say, 50 times) than the well radius. (Sims-ISWS)
W79-04128

THREE-DIMENSIONAL MODELING OF GROUNDWATER FLOW SYSTEMS,
Waterloo Univ., (Ontario). Dept. of Earth Sciences.
E. O. Frind, and M. J. Verge.
Water Resources Research, Vol. 14, No. 5, p. 844-856, October 1978. 15 fig, 3 tab, 30 ref, 1 append.

Descriptors: *Groundwater movement, *Mathematical models, *Finite element analysis, Equations, Saturated flow, Unsaturated flow, Continuity equation, Numerical analysis, Costs, Hydraulic conductivity, Porosity, Compressibility, Model studies, *Three-dimensional modeling, Galerkin technique.

Practical aspects of three-dimensional (3-D) modeling of groundwater flow systems were examined closely. A Galerkin finite element model was designed with a view to providing flexibility, user convenience, and a high degree of efficiency, qualities which are critical to the success of 3-D modeling of real systems. The model was based on the general saturated-unsaturated continuity equation. Several integration schemes and matrix solvers were compared, and relative costs were expressed as functions of grid size. Examples presented included a hypothetical system and a real system. Simulation costs generally were found to be reasonable for grids of the size encountered with real systems. It was found that a remaining obstacle to the unified treatment of saturated-unsaturated systems is that the optimum element sizes required for saturated and unsaturated flow are not always compatible because of constraints arising from the physical properties of the materials. In general, however, it appears that with presently available tools, 3-D analysis is a practical option. (Visocky-ISWS)
W79-04149

FINITE ELEMENT METHOD FOR SUBSURFACE HYDROLOGY USING A MIXED EXPLICIT-IMPLICIT SCHEME,
California Univ., Berkeley. Lawrence Berkeley Lab.
T. N. Narasimhan, S. P. Neuman, and P. A. Witherspoon.
Water Resources Research, Vol. 14, No. 5, p 863-877, October 1978. 19 fig, 2 tab, 32 ref, 2 append.

Descriptors: *Groundwater, *Subsurface flow, *Model studies, Mathematical models, Subsurface drainage, Groundwater movement, Aquifers, Finite element analysis, Mathematics, Equations, Storage, Wells, Drawdown, Hydraulic conductivity, Hydrology.

The mixed explicit-implicit Galerkin finite element method developed previously was shown to be ideally suited for a wide class of problems arising in subsurface hydrology. These problems include confined saturated flow, unconfined flow uner free surface condtions subject to the Dupuit assumption, flow in aquifers which are partly confined and partly unconfined, axisymmetric flow to a well with storage, and flow in saturated-unsaturated soils. A single computer program, entitled Flump, can now handle all of these problems. The mixed explicit-implicit solution strategy employed in the program insures a high level of accuracy and computation efficiency in most cases. It eliminates many of the difficulties that groundwater hydrologists have been encountering in trying to simulate extensive aquifer system by finite elements. Some of the outstanding features of this solution strategy include an automatic control of time step size, reclassification of nodes from explicit to implicit during execution, automatic adjustment of the implicit time-weighting factor, and the treatment of bounary conditions and source terms as arbitrary functions of time of the state of the system. Five examples were presented to demonstrate the versatility and poer of this new approach. A purely physical derivation of the finite element equations which does not rely on the Galerkin formalism also was included in one of the appendices. (Sims-ISWS)
W79-04163

HYDRAULICS IN THE COASTAL ZONE.
For primary bibliographic entry see Field 2L.
W79-04351

THE FRESH WATER LENS IN A BARRIER BEACH,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2L.
W79-04367

EVALUATION OF A BARRIER AGAINST SEAWATER INTRUSION,
Los Angeles County Flood Control District, CA.
For primary bibliographic entry see Field 2L.
W79-04370

GROUNDWATER-SURFACE WATER RELATIONSHIP NEAR LAKE MICHIGAN SHORE,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W79-04371

HYDROLOGIC INFORMATION FOR LAND-USE PLANNING, FAIRBANKS VICINITY, ALASKA,
Geological Survey, Anchorage, AK., Water Re-

sources Div.
G. L. Nelson.
Geological Survey open-file report 78-959, 1978. 47 p, 16 fig, 50 ref.

Descriptors: *Groundwater availability, *Water quality, *Water pollution sources, *Groundwater movement, *Surface-groundwater relationships, Transmissivity, Water table, Land use, Planning, Hydrologic data, Alaska, *Fairbanks area.

The flood plain on the Chena and Tanana Rivers near Fairbanks, Alaska, has abundant water in rivers and in an unconfined alluvial aquifer. The principal source of ground water is the Tanana River, from which ground water flows northwesterly to the Chena River. Transmissivity of the aquifer commonly exceed 100,000 sq ft. The shallow water table (less than 15 ft below land surface), high hydraulic conductivity of the sediments and cold soil give the flood plain a high susceptibility to pollution by onsite sewerage systems. The Environmental Protection Agency recommended maximum concentrations for drinking water may be exceeded in surface water for manganese and bacteria and in ground water for iron, manganese, and bacteria. Residents of the uplands obtain water principally from a widely-distributed fractured schist aquifer. The aquifer is recharged by local infiltration of precipitation and is drained by springs on the lower slopes and by ground-water flow to alluvial aquifers of the valleys. The annual base flow from basins in the uplands ranged from 3,000 to 100,000 gallons per acre; the smallest base flows occur in basins nearest the city of Fairbanks. The thick silt cover and great depth to the water table give much of the uplands a low susceptibility to pollution by onsite sewage disposal. Ground water is locally high in nitrate, arsenic, iron, and manganese. (Woodard-USGS)
W79-04391

WATER LEVELS IN ARTESIAN AND NONARTESIAN AQUIFERS OF FLORIDA, 1975-76,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. G. Healy.
Geological Survey open-file report 78-458, May 1978. 115 p, 54 fig, 1 tab, 3 ref.

Descriptors: *Groundwater resources, *Water levels, *Florida, *Aquifer characteristics, Observation wells, *Drawdown, Pumping, Groundwater recharge, Water level fluctuations, Hydrographs.

On the basis of measurements in 664 selected wells from a network total of about 2,100 observation wells, ground-water levels during May 1975-May 1976 declined from 2 to 4 feet in the Floridan aquifer throughout most of north and central peninsular Florida. Hydrographs of 60 wells show that the downward trends of ground-water levels continued in several areas of heavy pumping. The most notable area was in west-central Polk County where levels declined to new record lows in 1975 and 1976. In northwest Florida, declines ranged from less than 1 foot to 2 feet in the sand-and-gravel aquifer. In the northeastern, eastern and southwestern coastal parts of the State, levels declined to new record lows. (Woodard-USGS)
W79-04404

FREELAND V. DICKSON (LOWER LANDOWNER HAS NO RIGHT TO UNIMPEDED FLOW OF SURFACE WATER ONTO HIS LAND),
379 N.E. 2d 903-07 (111. Ct. App. 1978).

Descriptors: *Natural flow, *Surface waters, *Illinois, *Drainage, Adjacent land owners, Water control, Drainage, Flow, Culverts, Hydraulics, Agriculture, Water rights.

Plaintiffs, owners of land lying to the west of a highway culvert, sought to compel the defendant, owner of land lying east of the culvert, to remove artificial obstructions on the defendant's land which were impeding the natural flow of surface waters from plaintiffs' to defendant's land. The trial court issued a mandatory injunction and ordered the defendant to remove the obstructions. Defendant appealed. The Appellate Court held that ordering the removal of the obstructions was proper because under state law, where water from one tract of land falls naturally upon the land of another, the owner of the lower land must suffer the water to be discharged upon his land and has no right to stop or impede the natural flow of the surface water. However, the court refused to uphold portions of the order which required the defendant to excavate or lower the existing natural course of surface drainage and which required the plaintiffs to restore the level of natural drainage on their own land to a certain prior level. These parts of the order were deemed contrary to law. (Hucks-Florida)
W79-04434

HUELSMANN V. STATE (RECOVERY DENIED FOR LOSS OF WELL WATER CAUSED BY HIGHWAY CONSTRUCTION),
381 N.E. 2d 950-55 (Ohio Ct. App. 1977).

Descriptors: *Water loss, *Percolating water, *Wells, *Ohio, Subsurface waters, Groundwater, Base flow, Percolation, Water rights, Remedies, Damages, Alteration of flow.

Plaintiff property owners brought an action against defendant Ohio Department of Transportation, seeking damages for the complete loss of water in their well caused by highway construction. The State claimed plaintiffs' loss of subsurface or ground water which supplied the well constituted an injury without legal remedy because no action at law can lie for loss of percolating waters. The Ohio Court of Appeals, found that rights of ownership in subterranean waters arise to the same extent as exists between riparian owners of surface water, but only if the underground streams of water flow in well defined and well known channels which can be traced. Thus, one court held: the State was not liable to the property owner for the impairment or destruction of the use of the well water; the property owner was not entitled to direct or consequential damages for the injury; and further, the state had not duty to provide prior notice of impending damages. Additionally, since the waters in question were percolating waters, there were no material issues of genuine fact, so the trial court's summary judgement was upheld. (Rule-Florida)
W79-04456

THE USE OF BOUNDING WELLS TO COUNTERACT THE EFFECTS OF GRAVITY IN DIPPING AQUIFERS,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 4B.
W79-04496

2G. Water In Soils

THE COMPLEXING AND ADSORPTION OF CADMIUM IN SOILS IN THE PRESENCE OF EDTA AND NTA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W79-04007

CLIMATE, SOIL, AND VEGETATION--1. INTRODUCTION TO WATER BALANCE DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04037

CLIMATE, SOIL, AND VEGETATION--3. A SIMPLIFIED MODEL OF SOIL MOISTURE MOVEMENT IN THE LIQUID PHASE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
P. S. Eagleson.
Water Resources Research, Vol. 14, No. 5, p 722-730, October 1978. 13 fig, 15 ref.

Descriptors: *Soil water movement, *Soil moisture, *Model studies, Mathematical models, Infiltration, Percolation, Capillary water, Capillary fringe, Soils, Soil properties, Hydraulic conductivity, Pore water, Pores, Wetting, Drying, Precipitation(Atmospheric), Evapotranspiration, Soil water.

Natural soil systems were modeled one dimensionally from the surface to a stationary water table by a homogeneous medium defined by three independent parameters. Four varieties of soil moisture movement were anlyzed separately, and their effects were linearly superimposed. Infiltration and exfiltration were described by the Philip equation, which assumes the medium to be effectively semi-infinite, and the internal soil moisture at the beginning of each storm and interstorm period was assumed to be uniform at its long-term space-time average. The exfiltration equation was modified for the presence of natural vegetation through the approximate introduction of a distributed sink representing the moisture extraction by plant roots. Gravitational percolation to groundwater was assumed to be steady throughout the rainy season at a rate determined by the long-term space-time average soil moisture. Capillary rise from the water table was assumed to be steady throughout the year and to take place to a dry surface. (See also W79-04037) (Sims-ISWS)
W79-04039

CLIMATE, SOIL, AND VEGETATION--6. DYNAMICS OF THE ANNUAL WATER BALANCE,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04042

CLIMATE, SOIL, AND VEGETATION--7. A DERIVED DISTRIBUTION OF ANNUAL WATER YIELD,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W79-04043

EFFECT OF ENTRAPPED SOIL AIR ON INFILTRATION,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
A. R. Jarrett, and D. D. Fritton.
Transactions of the American Society of Agricultural Engineers, Vol. 21, No. 5, p 901-906, September--October 1978. 11 fig, 2 tab, 11 ref.

Descriptors: *Air entrainment, *Soil water, *Infiltration, Soil water movement, Hydraulic gradient, Soil profiles, Darcys law, Hydraulic conductivity, Mathematical models, Equations, Wetting, Pressure, Loam, Model studies, Trapped air, Soil air.

During a rainfall event, water at the soil surface can either infiltrate into the soil or become runoff. The rate at which water enters the soil often is assumed to occur independently of the disposition of the soil air contained in the unsaturated medium. If, however, conditions are such that the air cannot escape, it will be trapped within the soil profile ahead of the infiltrating front. As the infiltration process continues, the trapped air compresses; and the increased air pressure reduces the hydraulic head gradient driving the infiltration process and reduces the infiltration rate. The pressure of the trapped air within the soil profile increases until the internal pressure reaches a certain value, where the air can escape through the surface via large pores. This reduces the air pressure and allows infiltration to continue at an increased rate. (Visocky-ISWS)
W79-04124

THE ROLE OF NITRATE DIFFUSION IN DETERMINING THE ORDER AND RATE OF

DENITRIFICATION IN FLOOD SOIL: I. EXPERIMENTAL RESULTS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
K. R. Reddy, W. H. Patrick, Jr., and R. E. Phillips.
Soil Science Society of America Journal, Vol. 42, No. 2, p 268-272, March-April, 1978. 5 fig, 3 tab, 18 ref.

Descriptors: *Denitrification, Nitrates, Anaerobic conditions, Flooding, Submergence, Nitrogen, Diffusion, Incubation.

Fifteen soils from various locations in the U.S. were amended with 0.5% rice straw and incubated under saturated conditions without O2, either with no excess floodwater or with a 3-cm overlying layer of floodwater. The disappearance of added and native NO3(-)-N and its conversion to N2 and N2O followed apparent zero-order reaction kinetics when all the NO3(-)-N was present in the active soil layer (no excess floodwater). When added NO3(-)-N was present in both the floodwater and the soil layer, NO3(-)-N disappearance followed apparent first-order reaction kinetics. A decrease in NO3(-)-N concentration in the soil layer caused NO3(-)-N in the floodwater to diffuse into the soil layer (a first-order reaction with respect to NO3(-)-N concentration) where it was denitrified. The rate of denitrification was faster in soils incubated with no excess floodwater compared to soils incubated under 3 cm of floodwater. One soil (Crowley silt loam), when incubated with no added carbon source and no excess floodwater, showed (NO3(-)-N disappearance to follow first-order kinetics. When this soil was incubated with an additional carbon souce, NO3(-)-N disappearance was zero order. (See also W79-04131) (Skogerboe-Colorado State)
W79-04130

THE ROLE OF NITRATE DIFFUSION IN DETERMINING THE ORDER AND RATE OF DENITRIFICATION IN FLOODED SOIL: II. THEORETICAL ANALYSIS AND INTERPRETATION,
Kentucky Univ., Lexington. Dept. of Agronomy.
R. E. Phillips, K. R. Reddy, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 2, p 272-278, March-April, 1978. 7 fig, 13 ref, append.

Descriptors: Denitrification, Nitrates, Flooding, Submergence, Nitrogen, Diffusion, Theoretical analysis.

A theoretical analysis of denitrification occurring in submerged soil in a test tube, when assumed to be a zero-order reaction with available organic carbon nonlimiting, appears to be a first-order reaction if the effects of diffusion are neglected. This is so because denitrification occurs at a faster rate than the diffusive flux can supply NO3(-)-N to the soil. After some length of time, the concentration of NO3(-)-N in the lower portion of the floodwater-soil interface will be equal to the concentration in the flood-water. After which time, denitrification occurs only in the upper portion of the soil sample. It is suggested that the true order of reaction and rate constant of denitrification in a test tube can be evaluated experimentally by eliminating the floodwater above the soil sample; with this experimental geometry some of the confounding effects of diffusion of NO3(-)-N can be minimized. If diffusion is neglected, not only is the order of reaction misjudged but the depth of floodwater above the soil has a significant effect on the magnitude of the calculated rate constant of the apparent first-order reaction also. (See also W79-04130) (Skogerboe-Colorado State)
W79-04131

THE DEPENDENCE OF THE PARAMETERS IN THE GREEN AND AMPT INFILTRATION EQUATION ON THE INITIAL WATER CONTENT IN DRAINING AND WETTING STATES,
Cambridge Univ. (England). Dept. of Applied Biology.
S. Aggelides, and E. G. Youngs.
Water Resources Research, Vol. 14, No. 5, p 857-862, October 1978. 10 fig, 1 tab, 22 ref.

Descriptors: *Infiltration, *Equations, *Mathematical studies, *Soil water movement, Moisture content, Drainage, Wetting, Sand, Model studies, Theoretical analysis, Pressure head, Soil physical properties, Hysteresis, Green and Ampt equation, Richards equation, Wetting front.

The parameters in the Green and Ampt infiltration equation were determined from infiltration experiments in a sand column at various uniform initial water contents in both draining and wetting states. The parameters were compared with various estimates obtained from the soil water properties measured on the same experimental column. The estimates of the soil water pressure head at the wetting front were generally more negative than the values obtained from the directly measured parameters. It was found that the calculated cumulative infiltration as a function of time was fitted better by using Bouwer's crude 'water entry' estimate than values deduced by approximating Richards' flow equation. (Visocky-ISWS)
W79-04155

EFFECTS OF SOLUTION CHEMISTRY AND ENVIRONMENTAL CONDITIONS ON AMMONIA VOLATILIZATION LOSSES FROM AQUEOUS SYSTEMS,
International Fertilizer Development Center, Florence, AL. Agro-Economic Div.
For primary bibliographic entry see Field 2K.
W79-04180

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: I. THEORY,
California Univ., Riverside. Dept. of Soil and Environmental Science.
W. A. Jury, H. Frenkel, and L. H. Stolzy.
Soil Science Society of America Journal, Vol. 42, No. 4, p. 579-585, July-August, 1978. 5 fig, 5 tab, 15 ref, 11 equ.

Descriptors: *Saline water, *Soil water movement, Chemical precipitation, Leaching, Diffusion, Travel time, *Cation exchange, Dispersion, *Irrigation water, *Soil-water interfaces.

Transient soil solution concentrations and salt precipitation rates in the root zone are shown to be influenced by the ion composition and concentration of the applied water and soil exchange complex as well as by the water uptake distribution and infiltration rate. Calculations are performed on three kinds of infiltration water to estimate the ionic composition of the soil solution, the rate of gypsum and CaCO3 precipitation, and the time to reach steady state for a given irrigation management. Solution concentrations adjusted for exchange interactions were shown to precipitate twice the quantity of salt in a given time, resulting in lowered solution concentration and altered composition of Ca(2+), Mg(2+), Na(2+), and SO4(2-) ion concentrations in the solution phase, with up to 1,600 days required to reach steady state through the top 150 cm for a leaching fraction of 0.05. The extent of precipitation is also found to depend strongly on the concentration of sulfate and degree of saturation with gypsum in the irrigation water. Diffusion and dispersion are also shown to influence the duration of the transient phase. (Skogerboe-Colorado State)
W79-04202

SURFACE CHARGE MANIPULATION OF CONSTANT SURFACE POTENTIAL SOIL COLLOIDS: I. RELATION TO SORBED PHOSPHORUS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 2K.
W79-04203

FACTORS AFFECTING DENITRIFICATION IN A SONORAN DESERT SOIL,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04204

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: II. ANALYSIS OF EXPERIMENTAL DATA,
California Univ., Riverside. Dept. of Soil and Environmental Science.
W. A. Jury, H. Frenkel, D. Devitt, and L. H. Stolzy.
Soil Science Society of America Journal, Vol. 42, No. 4, p 585-590, July-August, 1978. 4 fig, 7 tab, 13 ref, 3 equ.

Descriptors: *Saline water, *Soil water movement, Cation exchange, Chemical precipitation, Solutes, *Irrigation water, Wheat, Sorghum, Lysimeters, *Soil-water interfaces.

Twenty-three lysimeters containing four soil types with alternate wheat (Triticum aestivum L.) and sorghum (Sorghum vulgare Pers.) crops were irrigated with three synthesized levels (2.2, 3.9, 7.1 mmho/cm) of irrigation water. Salt balance was calculated from soil salinity sensor electrical conductivity EC measurements by determining a relationship between solution EC and solution concentration using a chemical equilbrium model. Exchangeable cations were measured after the third crop. All methods of determining salt balance showed the order of 50% salt precipitation over the first 500 days of the experiment, approximately two times the expected amount when root zone salt concentrations have reached steady state. Release of Ca(2+) ions from exchange sites and subsequent enhanced gypsum and Ca CO3 precipitation was assumed to be responsible for the difference between transient and steady-state behavior. The drainage composition of a lysimeter which had moved one pore volume through the root zone showed that only Cl(-) was approaching a steady-state value. Exchange effects and enhanced precipitation were assumed to be buffering the concentration of the other ions. Water uptake in all lysimeters was occurring primarily in the top 20 cm, a consequence of high irrigation water salinity and daily irrigation. (Skogerboe-Colorado State)
W79-04205

PHOSPHATE DESORPTION FROM KAOLINITE SUSPENSIONS,
Volcani Inst. fo Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
For primary bibliographic entry see Field 2K.
W79-04207

THERMODYNAMICS OF POTASSIUM-CALCIUM AND MAGNESIUM-CALCIUM EXCHANGE REACTIONS ON A KAOLINITIC SOIL CLAY,
Ibadan Univ. (Nigeria) Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04209

ATRAZINE MOBILITY IN TWO SOILS UNDER CONVENTIONAL TILLAGE,
Pennsylvania Agricultural Experiment Station, University Park. Dept. of Soil Chemistry and Weed Science.
J. K. Hall, and N. L. Hartwig.
Journal of Environmental Quality, Vol. 7, No. 1, p 63-68, January-March, 1978. 7 tab, 20 ref.

Descriptors: Pesticides, Herbicides, *Leaching, Lysimeters, Bioassay, *Soil contamination, *Atrazine.

Atrazine mobility was studied in two differenct Pennsylvania soils under conventional tillage. Atrazine mobility, dissipation rate, and residual activity were evaluated by chemical analysis and oat bioassay of soil cores sampled at 15-cm increments to 122 cm and from chemical analysis of suction lysimeter leachates. It appeared from this study that application of atrazine to fine-textured,

conventionally tilled soils at rates ranging from 1.0 to 4.5 kg/ha would not seriously affect ground water supplies through contamination by internal soil damage. (Skogerboe-Colorado State)
W79-04212

IMPORTANCE OF THE ORGANIC PHOSPHORUS FRACTION IN EXTRACTS OF CALCAREOUS SOIL,
Cotton Research Center, Phoenix, AZ.
For primary bibliographic entry see Field 2K.
W79-04213

ADSORPTION OF ALDICARB BY CLAYS AND SOIL ORGANO-CLAY COMPLEXES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
For primary bibliographic entry see Field 2K.
W79-04217

MULTICOMPONENT CATION ADSORPTION DURING CONVECTIVE-DISPERSIVE FLOW THROUGH SOILS: EXPERIMENTAL STUDY,
Utah State Univ., Logan. Dept. of Soils and Biometeorology.
For primary bibliographic entry see Field 2K.
W79-04218

THE AUTOMATIC DETERMINATION OF PPB LEVELS OF AMMONIA, NITRATE PLUS NITRITE, AND PHOSPHATE IN WATER IN THE PRESENCE OF ADDED MERCURY (II) CHLORIDE,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Soils.
For primary bibliographic entry see Field 2K.
W79-04226

A NEW APPROACH TO SOIL TESTING: III. DIFFERENTIAL ADSORPTION OF POTASSIUM,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04227

COLORIMETRIC DETERMINATION OF UREA IN SOIL EXTRACTS USING AN AUTOMATED SYSTEM,
Melbourne Univ., Parkville (Australia). Faculty of Agriculture and Forestry.
For primary bibliographic entry see Field 2K.
W79-04228

A KINEMATIC MODEL FOR SURFACE IRRIGATION,
New Mexico Inst. of Mining and Technology, Socorro.
B. Sherman, and V. P. Singh.
Water Resources Research, Vol. 14, No. 2, p 357-364, April, 1978. 10 fig, 41 ref.

Descriptors: *Surface irrigation, Mathematical models, Analytical techniques, *Infiltration, Hydrodynamics, Momentum equation.

A kinematic wave model is developed to study surface irrigation. Depending on the variability of infiltration and the kinematic wave friction parameter, three cases are distinguished. Explicit analytical solutions are obtained for the case when infiltration is constant, and a possible approach is suggested for the case when it is not. (Skogerboe-Colorado State)
W79-04230

ON OSCILLATION OF NUMERICAL SOLUTION OF A MODIFIED RICHARDS' EQUATION,
Utah International Inc., San Francisco, CA. Dept. of Environmental Quality.
N. Krishnamurthi, D. K. Sunada, and R. A. Longenbaugh.
Water Resources Research, Vol. 14, No. 1, p 52-54, February, 1978. 1 fig, 16 ref, 8 equ.

Descriptors: *Mathematical studies, Numerical analysis, *Soil water movement, *Hydraulic conductivity, Gravitational water, Diffusivity.

Numerical solutions of differential equations should be checked for the conditions of consistency, convergence, and stability. The implicit solutions that satisfy these conditions are sometimes found to be oscillatory about the true solutions. The reasons for these oscillations are explained. A method to derive criteria for nonoscillatory solutions of a nonlinear partial differential equation is outlined. These criteria for modified Richards' equation are presented, and their physical significances are explained. (Skogerboe-Colorado State)
W79-04231

DENITRIFICATION IN FOUR CALIFORNIA SOILS: EFFECT OF SOIL PROFILE CHARACTERISTICS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
J. W. Gilliam, S. Dasberg, L. J. Lund, and D. D. Focht.
Soil Science Society of America Journal, Vol. 42, No. 1, p 61-66, January-February, 1978. 4 fig, 3 tab, 25 ref.

Descriptors: *Denitrification, *Soil profiles, Steady flow, Soil water movement, Nitrates.

The effects of soil profile characteristics upon rate and products of denitrification were investigated using four soils in laboratory columns under steady-state water flow conditions. Soils with heavy textured subsoils readily reduced added NO3(-). However, the soil with the lowest clay content had restricted water flow in the surface horizon and reduced the greatest amount of NO3(-). It was concluded that any soil condition which impedes water flow will be positively related to denitrification and that spatial variability in denitrification is likely to be as great as observed variability in water movement. The ratio of N2 to N2O found during denitrification was extremely variable with measured values from 100:1 to 1:4. The low concentrations of N2O measured during denitrification occurred in soils where the denitrification was occurring deep in the soil profile, but there was no indication that this low concentration was a result of further reduction of N2O as N2O diffused through the soil profile. Our data indicate that it is currently not possible to accurately predict relative amounts of N2 and N2O which will be produced during most denitrification in soils, and that estimates of that N2O produced from agricultural lands have a large uncertainty factor. (Skogerboe-Colorado State)
W79-04234

EXTRACTABILITY OF 238PU AND 242CM FROM A CONTAMINATED SOIL AS A FUNCTION OF PH AND CERTAIN SOIL COMPONENTS: HNO3-NAOH SYSTEM,
California Univ., Los Angeles, Lab. of Nuclear Medicine and Radiation Biology.
H. Nishita, M. Hamilton, and A. J. Steen.
Soil Science Society of America Journal, Vol. 42, No. 1, p 51-56, January-February, 1978. 3 fig, 3 tab, 37 ref.

Descriptors: *Soil contamination, Pollutants, *Radioactivity, Nitrates, *Organic matter, Iron oxides, Hydrogen ion concentration, Silica, Ion exchange, Sorption.

The study involved an equilibrium batch technique using HNO3-NaOH extracting system. The influence of various soil components on 238Pu and 242Cm extractability was determined indirectly by selectively removing them from the soil. Soil organic matter, free iron oxides, and free silica, alumina, and amorphous alumino-silicates influenced the chemical extractability of 238Pu and 242Cm. The influence of these soil components depended on the pH of the soil suspension. Below pH close to 4.5, 238Pu appeared to be more strongly sorbed on the mineral fraction of the soil than 242Cm, but above pH close to 4.5, both were strongly sorbed on the mineral fraction. With the contaminated virgin soil, the 238Pu and 242Cm extractability ranged from 4.82 to 53.05% and 0.15 to 64.58% of dose, respectively, depending on the pH of the extracting solution. The lowest extractability occurred around pH 7.1 for 238Pu and in the range of pH 4.7 to 5.6 for 242Cm. (Skogerboe-Colorado State)
W79-04236

RESIDUAL FERTILIZER NITROGEN IN A FLOODED RICE SOIL,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
K. R. Reddy, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 2, p 316-318, March-April, 1978. 2 fig, 4 tab, 2 ref.

Descriptors: *Nitrogen, Stable isotopes, Fertilization, *Rice, *Flood irrigation, Incubation, Nutrients.

Residual effects of 15N-labelled fertilizer (ammonium sulfate) nitrogen were measured during the second cropping season of rice (Oryza sativa L.). During the first cropping season, labelled fertilizer N was applied at 100 kg N/ha using different methods of N application. At the end of harvest the rice straw obtained during the first cropping season was incorporated back into the respective plots. During the second season half the plots were treated with an additional 100 kg N/ha of nonlabelled fertilizer N as an early season top dressing. The uptake of residual labelled N was measured during the growing season and at harvest time under fertilized and nonfertilized conditions. The recovery of residual labelled N in grain and straw was 2.7 to 3.1 kg N/ha, with a large fraction of N still remaining in the soil. Approximately 3 to 5 kg of the residual labelled N/ha present at the beginning of the season was not accounted for in any fraction and was assumed to be lost from the system. Over a 2-year period, abour 66 to 82% of the applied labelled fertilizer N could be accounted for by plant uptake or in the soil with the remainder lost from the plant-soil system. (Skogerboe-Colorado State)
W79-04237

SODIUM BICARBONATE EXTRACTION TO ESTIMATE NITROGEN, PHOSPHORUS, AND POTASSIUM AVAILABILITY IN SOILS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
B. Bar-Yosef, and B. Akiri.
Soil Science Society of America Journal, Vol. 42, No. 2, p 319-323, March-April, 1978. 6 fig, 3 tab, 8 ref, 2 equ.

Descriptors: *Soil analysis, *Soil chemical properties, Soil tests, Nitrogen, *Phosphorus, *Potassium, Calcareous soils, Sodium compounds, Nutrients.

The extractability of NO3-N, P, and K from five calcareous soils differing in physical and chemical characteristics by NaHCO3 (0.5M, pH 8.5) was studied under laboratory conditions. The extracted amounts of the three ions were related to time since their application to the soils, to the equilibration period of the soils with the extractants, to the concentration of the ions in the soils, and to the clay content of the soils. After about 70 days in the soil, the extractability of each ion at a given application level was independent of time. The recovery percentage of P and K as a function of the applied amounts of these elements depended mainly on the clay content of the soils, while NO3-N recovery was independent of the factors studied. Linear relationships were obtained between NaHCO3- and NH4OAC-extracted K, and NaHCO3- and KCl-extracted NO3-N. The slopes for NO3-N were 45 degrees for all soils, but were specific for each soil in the case of K. (Skogerboe-Colorado State)
W79-04238

ARTIFICIAL RECHARGE: PART II,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 4B.
W79-04239

TRITIUM TRACING OF UNSATURATED MOISTURE MOVEMENT,
Clemson Univ., SC. Dept. of Agricultural Engineering.
J. T. Ligon, T. V. Wilson, J. F. Allen, and U. P. Singh.
ASAE Paper No. 75-2015, 1975. Presented at American Society of Agricultural Engineers Annual Meeting, University of California, Davis, June 15-22, 1975. 17 p, 9 fig, 6 ref. OWRT A-023-SC(7).

Descriptors: *Path of pollutants, *Soil moisture, *Tracers, *Watersheds, *Water table, *Soil science, Soil moisture meters, Percolation, Soil tests, Clay, Loam, Sands, Soil investigations, Soil groups, Soil horizons, Soil profiles, Sampling, Soil water movement, Moisture content, Transfer, Soil contamination, Adsorption, Tracking techniques.

Tritium (H-3), a radioactive tracer, was used to define the rate of downward displacement of moisture in the unsaturated portion of a typical Piedmont soil profile in a study to determine the relationship between measured displacement and the displacement predicted from excess root zone moisture and profile moisture content. Tracer experiments were initiated during December 1972 and January 1973 in the Pacolet sand loam on the Clemson (South Carolina) Research Watershed. Daily soil sampling and laboratory counting were started immediately and continued for 693 days. The several conclusions resulting from this study include: (1) the observation of the rate of downward movement of the tagged water inicates that initial contact with the water table about 20 meters deep will occur approximately 5.2 years after placement of the tracer 15 cm deep; (2) maximum activity levels will reach the water table after about 5.7 years; (3) the activity level will be only slightly above background levels when the material reaches the water table due to diffusion and dispersion; (4) very little lateral displacement of the material was observed except for the diffuson and dispersion; and (5) the differential rate of movement through the high clay B-horizon resulting in temporary retention of an area of maximum concentration in one zone and progressively deeper maximum activity in another area may be due to differential adsorption of tritium by clay particles. (Davison-IPA)
W79-04266

IRRIGATION WATER MOVEMENT BELOW THE CORN ROOT ZONE IN CRETE SILT LOAM,
Kansas State Univ., Manhatten. Evapotranspiration Lab.
L. R. Stone, R. J. Raney, E. T. Kanemasu, and W. L. Powers.
Journal of Soil and Water Conservation, Vol. 33, No. 6, p 294-296, November-December 1978. OWRT A-069-KAN(5).

Descriptors: Crete silt loam, *Irrigation schedules, *Water movement, Root zone, Corn.

To better understand the perched water table problem in the Bostwick Irrigation District of Kansas, the extent of water movement below the corn root zone in Crete silt loam (fine, montmorillonitic, mesic, typic, Argiustoll) was evaluated at the Irrigation Experiment Field near Scandia. Little or no water moved through the 150-to 180-centimeter layer durng the study. What water movement took place in this layer was predominantly upward. Maximum upward soil water flux was about 0.02 centimeters per day. Slight water content change and slight water movement in the 150- to 180-centimeter layer indicated little root activity in this zone. In managing this soil one should consider the surface 90 centimeters when determining water reserves available to plants and when planning irrigation schedules. Deep-profile water movement resulting from irrigation did not contribute to the perched water table.
W79-04483

RESPONSES OF SEVERAL FORAGE AND FIELD CROPS TO SUBSURFACE SOIL WARMING AND SEWAGE EFFLUENT SPRAY IRRIGATION,
The Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 3F.
W79-04489

THE EFFECT OF COMBINED SOIL WARMING AND IRRIGATION ON THE SOIL SURFACE ENERGY BUDGET,
The Pennsylvania State Univ., University Park. Dept. of Meteorology.
D. R. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 282, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, May 1977. 114 p, 27 fig, 9 tab, 7 append, 7 ref. OWRT C-6249(No 5222)(2).

Descriptors: *Soil temperature, Energy budget, Precipitation(Atmospheric), *Evapotranspiration, *Sewage effluents, *Irrigation effects.

Micrometeorological measurements were made on an artificially heated plot of ground and an adjacent control plot to determine differences in the soil surface energy budget. Both plots were irrigated biweekly with secondary treated sewage effluent. Artificial heating effects on the soil surface energy budget are discussed. Estimates of the distribution of artificially introduced energy into latent and sensible heat are given. An evapotranspiration prediction scheme using net radiation, soil surface heat flux density and air vapor pressure deficit as parameters was developed. Measured and predicted evapotranspiration permit the calculation of an annual value. Annual values of net radiation and heat flux density combined with the evapotranspiration yield an annual sensible heat. Evapotranspiration and soil water drainage were measured with non-weighing microlysimeters. Maximum annual irrigation estimates are made for the artificially heated plot from the annual evapotranspiration and drainage rate. The distribution of irrigation and precipitation into evapotranspiration and drainage is discussed. The influence of several micrometeorological conditions on the energy budget is investigated. The applicability of the experimental results to a full scale artificial soil warming system is discussed. (Sink-Penn State)
W79-04490

2H. Lakes

MOVEMENTS OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN IMPOUNDED WATERS AS DETERMINED BY UNDERWATER TELEMETRY,
Mississippi State Univ., Mississippi State.
R. L. Warden, Jr., and W. J. Lorio.
Transactions of the American Fisheries Society, Vol. 104, No. 4, p 696-702, October 1975. 2 fig, 2 tab, 6 ref. OWRT A-066-MISS(2).

Descriptors: *Fish behavior, *Largemouth bass, *Impounded waters, Aquatic habitats, Migration, Telemetry, Tagging, Tracking techniques, Water temperature, Diurnal, Nocturnal, Seasonal.

A sonic tracking program was undertaken with the following objectives: (1) to determine the home range of largemouth bass in impounded waters; (2) to determine behavior patterns associated with activity within a home area; and (3) to determine water management practices and environmental parameters resulting in increased or decreased movement. Tags with an average life of 13.8 days were implanted in the body cavity of the fish and appeared to have no effect on the movements of the fish. Sixteen fish were tracked for a total of 570 hours from March 4, 1972 to April 14, 1973. Water temperature was the only parameter related to increases or decreases in movement. Fish were most active in March and September, least active in January and December. Diurnal movement prevailed during the spring and fall, while nocturnal movement increased as the water temperature increased during the summer. Home ranges differed according to water temperature changes, and behavior patterns within them were movements from shallow to deep water. (Davison-IPA)
W79-04016

LIMNOLOGICAL CHARACTERISTICS OF CYPRESS LAKE, UPPER KISSIMMEE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
N. Gaggiani, and B. F. McPherson.
Geological Survey Water-Resources Investigations 77-45 (open-file report), 1978. 1 sheet, 8 fig, 7 tab, 9 ref.

Descriptors: *Florida, *Lake morphology, *Limnology, *Water quality, *Water levels, Inflow, Discharge(Water), Nutrients, Eutrophication, Dissolved solids, Maps, *Cypress Lake, Upper Kissimmee River basin.

Cypress Lake is in the upper Kissimmee River basin in Florida between Lake Tohopekaliga and Lake Hatchineha. It is remote from urban development and extensive agriculture. Nevertheless, most of the inflow to the lake, about 302,000 acre-ft per year, comes from 2 canals and a creek that drain the upper part of the basin which receives effluent from about 35 percent of the Orlando metropolitan area. With this inflow and a lake volume of 26,100 acre-ft, water in the lake is renewed about every 0.1 year. Cypress Lake has a surface area of 6.4 sq mi, a mean depth of 6.4 ft, an immediate overland drainage area of 29 sq mi and with Lake Hatchineha, receives drainage from 1,162 sq mi. From 1950 to 1964, before locks and dams at the outlets of Lakes Kissimmee and Tohopekaliga regulated water levels at Cypress Lake, water levels fluctuated from 57 ft msl to 48 ft msl, periodically flooding the surrounding area. After regulation from 1964 to 1975, the maximum water level at Cypress Lake was slightly more than 54 ft msl. Specific conductance of the water increased in Cypress Lake from an average of 76 micromho/cm in 1954-65 before regulations to 130 micromho/cm in 1964-75 after regulation. Cypress Lake is classified as a colored alkaline lake with an average color of 79 platinum cobalt units. Emergent marsh vegetation covers almost all the shoreline of the lake. (Woodard-USGS)
W79-04025

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-04068

THE ECONOMIC IMPACT OF INCREASED FOREST AND FARMLAND BEAVER DAMAGE IN MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.
D. H. Arner, and J. S. DuBose.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 991, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University, October 1978. 41 p, 5 fig, 9 tab, 8 ref. OWRT A-999-MISS(14).

Descriptors: *Impounded waters, *Ponds, *Damages, Beavers, Mississippi.

A recent inventory of Mississippi beaver ponds indicated 29,128 ha (71,920 ac) of land have been inundated by beaver activity. The average period of impoundment for these inundated lands is nine years. Beaver damage losses were assessed by determining the dollar value of timber, row crop, and beef production precluded on impounded lands. The loss of production on 23,346 ha (57,644 ac) of

timberland, 5,696 ha (14,064 ac) of cropland, and 86 ha (212 ac) of pasture flooded by beaver activity was valued at $22,205,285. This figure represents an average annual loss of $2,467,254 from Mississippi's agricultural economy. Abatement of beaver damage losses is not foreseen in the immediate future.
W79-04074

DYNAMICS OF WAVE-INDUCED CURRENTS IN SEDIMENTS,
Mississippi State Univ. Mississippi State. Dept. of Geology and Geography.
For primary bibliographic entry see Field 2J.
W79-04076

A HYDRAULIC MODEL STUDY OF PROPELLER-TYPE LAKE DESTRATIFICATION PUMPS,
Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
D. K. McLaughlin, and M. R. Givens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 901, Price codes: A04 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute, Oklahoma State University, Technical Completion Report, 1978. 62 p, 18 fig, 3 tab, 16 ref, 3 append. OWRT A-075-OKLA(1), 14-34-0001-8038.

Descriptors: *Reaeration, Destratification, Model studies, Hydraulic models, Pumps, *Discharge(Water), *Garton pump.

A hydraulic model study was performed of the local destratification phenomenon using a Garton type propeller prototype and model experiments. Geometrically similar models of a Garton pump were constructed in varying sizes. Experiments were conducted to model the near flowfield of the propeller in the vicinity of a typical dam and release structure. The local destratification experiments involved pumping a jet of surface water down into the heavier bottom water. With the pump located directly over the release inlet structure, the jet from the pump outflow can enhance the quality of water from the release. Successful modeling of the near flowfield of the propeller was achieved. The fundamental modeling parameter is the overall Richardson number. Important initial conditions are pump size ratios and thermocline location. A direct correlation between the nondimensional penetration depth of the jet and the dilution factor of the release samples was established. As the penetration depth of the jet reaches the level of the release intake structure, the dilution factor rapidly increases from zero. Performing experiments with different pump sizes indicates that the largest pump can force top water deeper at the same average axial velocity than the other pumps. The smallest propeller was more effective at improving the quality of water from the release using the same power consumption as the other propellers.
W79-04079

LIFE IN THE GREAT SALT LAKE,
Utah State Univ., Logan. Coll. of Science.
F. J. Post.
Utah Science, Vol. 36, No. 2, p 43-47, June 1975. 3 fig, 2 tab, 1 ref. OWRT-A-024-UTAH (1).

Descriptors: *Saline lakes, *Great Salt Lake, *Biology, Aquatic life, Aquatic environment, Brine shrimp, Bacteria, Aquatic bacteria, Algae, Saline water, Salts, Sodium compounds, Water pollution, Water pollution sources, Water pollution effects.

A study of the biology of the Great Salt Lake north of the railroad causeway is reported. Evaporation losses in the north arm of the lake are compensated for by a flow of water from the south end of the lake, which carries salt and organic matter. The salt level at the north end of the lake has reached the saturation point for sodium chloride, so that this chemical precipitates out on the lake bottom in deposits several feet thick. The few organisms know to live in this harsh environment are: red algae, green algae, brine fly, brine shrimp, halophillic bacteria, and bacterial viruses. Very little is known about the fundamental biology brine systems like the Great Salt Lake. It is a terminal lake at the end of a large watershed where a population of about two million live. All the wastes -- industrial, agricultural and human -- of this population enter the lake as organic matter or chemical elements. The large numbers of bacteria, algae, shrimp, and brine flies indicate that the organic matter is accumulating. Chemical and biological studies are currently being conducted to determine the rates at which the organic materials are cycled within the lake. (Davison-IPA)
W79-04095

FOSSIL PIGMENTS IN MINNESOTA LAKE SEDIMENTS AND THEIR BEARING UPON THE BALANCE BETWEEN TERRESTRIAL AND AQUATIC INPUTS TO SEDIMENTARY ORGANIC MATTER,
E. Gorham, and J. E. Sanger.
Verhandlungen, Internationale Vereinigung for Limnologie, Vol. 19, p 2267-2273, Nov. 1975, 2 tab, 16 ref. Contribution No. 129 from the Limnological Research Center, University of Minnesota. OWRT B-081-MINN(2).

Descriptors: *Pigments, Sediments, *Lakes, Carotenoids, Chlorophyll, Organic matter, Minnesota.

Comparison of pigment concentrations in sedimentary organic matter with those in potential source materials indicates that the major inputs to profundal sedimentary organic matter in Minnesota lakes are aquatic. It seems likely that terrestrial inputs are of considerable importance only in the relatively unproductive northeastern lakes with the lowest concentrations of sedimentary pigments. (Waelti-Minn)
W79-04129

THE PRODUCTION OF MUCILAGE BY DIATOMS IN MCCONAUGHY, PAWNEE AND YANKEE HILL RESERVOIRS AND THE ROLE OF THIS MATERIAL IN THE AQUATIC ENVIRONMENT,
Nebraska Univ., Lincoln. School of Life Sciences.
J. R. Rosowski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 306, Price codes: A04 in paper copy, A01 in microfiche. Nebraska Water Resources Center, University of Nebraska Project Completion Report, January 1979. 50 p, 18 fig, 9 tab, 30 ref. OWRT A-043-NEB(1), 14-34-0001-8029.

Descriptors: *Algae, Bacteria, *Diatoms, Mucilage, Sediments, Water chemistry.

The role of diatom mucilage was examined through a study of algae, water chemistry and physical parameters of three reservoirs in Nebraska--Yankee Hill and Pawnee, small shallow reservoirs, and McConaughy, the largest reservoir in the state. Observations from artificial and natural substrates indicated that diatoms were early invaders and remained the dominant periphytic organisms until they were naturally sloughed off. Diatoms forming mucilaginous stalks dominated the periphyton in the fall of 1976 in McConaughy, in samples 2-4 weeks old; in Pawnee, only by the 4th week; and in Yankee Hill, staled diatoms never dominated the periphyton on plexiglass. Scanning electron microscopy of in situ development indicated that the diatom communities were patchy since unialgal stands of high density developed and remained largely unmixed in the 4-week community. All species of diatoms examined released mucilage from their valve face and mantle, as well as from the girdle region. Distinct forms of bacteria (rods, cocci, caulobacters) were found associated with living diatoms. Diatom mucilages bound suspended particulates, but bacterial extracellular strands are also important in this regard. Considering the conspicuous nature of diatom mucilage in the periphytic community and its association with other algae, bacteria and sediments, mucilage is viewed as having an important but as yet unclear role in the biological and chemical recycling in natural waters.
W79-04310

INTAKE SCREENWELL SURGING CAUSED BY WAVE DYNAMICS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 8A.
W79-04357

DETERMINATION OF FLOOD LEVELS ON THE PACIFIC NORTHWEST COAST FOR FEDERAL INSURANCE STUDIES,
CH2M/Hill, Redding, CA.
For primary bibliographic entry see Field 2L.
W79-04359

WAVE RUNUP ON IRREGULAR BEACH PROFILES,
MacLaren (James F.) Ltd., Toronto (Ontario).
For primary bibliographic entry see Field 2L.
W79-04362

MINIMIZING WAVE TRANSMISSION THROUGH JETTIED INLETS,
Worcester Polytechnic Inst., Holden, MA. Alden Research Lab.
J. C. Roberge.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 121-129, 1977. 9 fig, 2 tab, 15 ref.

Descriptors: *Inlets(Waterways), *Waves(Water), *Jetties, *Lake Michigan, *Model studies, Hydraulic models, Laboratory tests, Hydraulic structures, Refraction(Waterwaves), Deep water, Shallow water, Shoals, Analysis, *Pigeon Lake(MI), Wave transmission.

Various remedial structure schemes for the reduction of wave transmission through the proposed enlargement of a jettied inlet on Lake Michigan were studied in a 1:65 undistorted scale hydraulic model. Wave induced bank erosion and deposition of suspended material in the inlet channel also were observed, employing moveable bed tracer material. Waves propagating through a parallel jettied inlet can be attenuated effectively by introducing rubble slopes along the sides of the structures. The wave height reduction was demonstrated to be linearly proportional to the length of the rubble section for structures composed of armor units of uniform size and shape. It follows that further attenuation could be achieved by optimizing armor stone characteristics with respect to size, shape, and roughness. The hydraulic model tests described demonstrated that the proposed widening of the Pigeon Lake Inlet would exopose Pigeon Lake to more severe wave action than currently exists. (See also W79-04351) (Humphreys-ISWS)
W79-04363

MODELING DISSOLVED OXYGEN IN THE NEAR-FIELD,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04366

GROUNDWATER-SURFACE WATER RELATIONSHIP NEAR LAKE MICHIGAN SHORE,
Illinois State Water Survey, Urbana.
A. P. Visocky.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 195-202, 1977. 4 fig, 3 ref.

Descriptors: *Lake Michigan, *Lake shores, *Groundwater, *Surface waters, *Illinois, Shores, On-site investigations, Water quality, Water levels,

Monitoring, Instrumentation, Flood plains, Precipitation(Atmospheric), Flooding, Barriers, Barrier bars.

Illinois Beach State Park, located along the shores of Lake Michigan 40 miles north of Chicago, is a popular recreational site for the people of northeastern Illinois and southern Wisconsin. High water table levels in vicinity of the park lodge have resulted in basement flooding. Park roadways are often flooded in low sections during heavy storms. Between January 1975 and April 1976, groundwater, stream, and Lake Michigan water level data were collected, as were water samples and precipitation records. The causes of roadway flooding and seepage in the park lodge basement were pinpointed. Certain observations can be made about potential problems in northward park development. Certain observations can be made about potential problems in northward park development. First, surface drainage there should not be the problem it is in the southern half of the park; no extensive marshy areas exist as in the Nature Preserve. Second, the water table is shallow, as in the south, and water free basements will be maintained only by dewatering. The water table problems will be more accute, of course, at any nearshore site. Third, groundwater quality appeared to be a bit better than along Wadsworth Road, but not as good as in the Nature Preserve. (See also W79-04351) (Humphreys-ISWS)
W79-04371

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
For primary bibliographic entry see Field 8B.
W79-04372

WISCONSIN'S ENVIRONMENTAL DECADE, INC. V. DEPARTMENT OF NATURAL RESOURCES (CITY POLICY COULD NOT PREVENT CHEMICAL TREATMENT OF STATE WATERS),
271 N.W. 2d 69-79 (Wisc. 1978).

Descriptors: *Chemicals, *Water quality, *Wisconsin, *Aquatic weeds, Navigable waters, Public health, Aquatic weed control, Municipal water, Water resources, Lakes, Algae, Water management.

The defendant Wisconsin Department of Natural Resources (DNR) granted permits for the chemical treatment of aquatic weeds to a small group of riparian property owners. The land owners lived on lakes located in the city of Madison. The City protested the issuance of the permits pursuant to a municipal policy protesting and prohibiting chemical treatment of city lakes. This proceeding was brought to review the order of the state agency. The Wisconsin Supreme Court held that pursuant to state statutes authorizing the DNR to 'supervise chemical treatment' of state waters and the agency's position as trustee of navigable state waters, there was authority to grant permits to chemically control aquatic nuisances despite municipal policy to the contrary. The court further held that the city policy repudiating the practice of chemical treatment of city lakes and the policy of protesting and preventing the use of chemical by others was inconsistent with state statutes. Whatever authority the city could exercise regarding the chemical treatment of noxious weeds on city lakes--waters which had nonlocal impact and were expressly a matter of statewide concern--depended on statutory approval which was absent here. (Hucks-Florida)
W79-04428

2I. Water In Plants

USE OF K/RB RATIO TO CHARACTERIZE POTASSIUM UPTAKE BY PLANT ROOTS GROWING IN SOIL,
Purdue Univ., Lafayette. IN. Dept. of Agronomy.
V. C. Baligar, and S. A. Barber.
Soil Science Society of America Journal, Vol. 42, No. 4, p 575-579, July-August, 1978. 3 fig, 5 tab, 18 ref, 2 equ.

Descriptors: *Potassium, *Root systems, Root development, Moisture uptake, *Ion exchange, Sweet corn, Growth chambers.

Interaction between the plant root and the soil on cation influx into the root is not well understood. Use of the ratio of K/Rb, two ions absorbed interchangeably by the root, enables measurement of the K ion medium influencing K flux into the root. In experiments with corn (Zea mays L.) grown in eight soil-K systems in a growth chamber, the K/Rb ratio of uptake was similar to the K/Rb ratio of the ions on the exchange sites, and not the K/Rb ratio of the solution cations. The data may be interpreted to indicate that K and Rb on the exchange sites had more influence on K and Rb flux into the root than K and Rb in solution. Diffusion of K and Rb from the soil to H-saturated exchange membranes was in the ratio of K/Rb in solution. (Skogerboe-Colorado State)
W79-04206

TRANSPORT OF MICROORGANISMS IN SAND COLUMNS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
A. G. Wollum, II, and D. K. Cassel.
Soil Science Society of America Journal, Vol. 42, No. 1, p 72-76, January-February, 1978. 6 fig, 5 tab, 8 ref.

Descriptors: Microorganisms, Saturated flow, Wastes, Sewage effluents, *Bacteria.

Transport of streptomycete conidia through saturated columns of uniformly packed sand was studies using miscible displacement techniques. Autoclaved sand was uniformly packed to give sand columns 20.3 and 152 cm high. Mean pore water velocities ranged from 14.4 to 131 cm/hour. A pulse of sterile water containing from 10000 to 1000000 conidia and tagged with 36C1 was displaced through each column with sterile water. Column effluent was collected and analyzed for conidia by serial dilution techniques utilizing starch-casein agar. At the termination of each run, the column was sampled and analyzed for conidia distribution. (Skogerboe-Colorado State).
W79-04211

POTASSIUM AND RUBIDIUM ADSORPTION AND DIFFUSION IN SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
For primary bibliographic entry see Field 2K.
W79-04216

A NEUTRON ACTIVATION METHOD FOR DETERMINING SUBMICROGRAM SELENIUM IN FORAGE GRASSES,
Missouri Univ.-Columbia. Dept. of Agronomy.
K. A. Cook, and E. R. Graham.
Soil Science Society of America Journal, Vol. 42, No. 1, p 57-60, January-February, 1978. 1 fig, 5 tab, 7 ref.

Descriptors: Fescues, *Forage grasses, *Neutron activation analysis, Radiochemical analysis, Irradiation.

Neutron activation as a method for the analysis of submicrogram amounts of Se in fescue and orchard leaves was evaluated. It was observed that the Se content of National Bureau of Standard orchard leaves was 0.078 ppm compared with the NBS reported value of 0.080 ppm Se. The relative standard deviation for the orchard leaves was found to be 5.3%. Following irradiation and nitric-perchloric acid digestion, Se was extracted from a 4M HBr solution using benzene containing 1% phenol. The method is sufficiently sensitive to measure with accuracy 0.010 ppm Se in 0.250 g of material. The method is straightforward and accurate and requires the extraction of Se benzene which is completely free of phosphorus. (Skogerboe-Colorado State)
W79-04235

A TECHNIQUE FOR ASSESSING SEEDLING EMERGENCE UNDER DROUGHT STRESS,
Utah Agricultural Experiment Station, Logan.
For primary bibliographic entry see Field 3F.
W79-04280

WATER UPTAKE BY PLANTS: I. DIVIDED ROOT EXPERIMENTS,
Geological Survey Menlo Park, CA. Water Resources Div.
W. N. Herkelrath, E. E. Miller, and W. R. Gardner.
Soil Science Society of America Journal, Vol. 41, No. 6, p 1033-1038, November-December, 1977. 13 fig, 22 ref, 5 equ.

Descriptors: *Soil water, Soil moisture, *Root systems, Root zone, Root development, Crop production.

The influence of soil water content and soil water potential upon root water uptake was investigated in a controlled laboratory environment. Water extraction rates by roots of winter wheat were measured in situ in a soil column instrumented with a gamma-ray attenuation water-content meter, tensiometers, and physchrometers. In addition, the leaf water potential was measured with an in situ leaf hygrometer. In order to measure the vertical distribution of water uptake, the column was divided into five sections by wax layers which were penetrated by roots, but which prevented movement of water between sections in the soil. (See also W79-04349)(Skogerboe-Colorado State)
W79-04348

WATER UPTAKE BY PLANTS: II. THE ROOT CONTACT MODEL,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. N. Herkelrath, E. E. Miller, and W. R. Gardner.
Soil Science Society of America Journal, Vol. 41, No. 6, p 1039-1042, November-December, 1977. 7 fig, 1 tab, 6 ref.

Descriptors: Model studies, Root development, *Root systems, *Soil water, Soil moisture, Simulation analysis.

In the standard analysis of root water uptake, it is assumed there is a constant root membrane resistance in series with a soil resistance which is dependent upon the soil moisture diffusivity. The relation of root extraction rate to soil water content and to soil water potential predicted by this standard model was compared to the results of divided root experiments. The extraction rates predicted by the theory were as much as eight times larger than the measured values. A reasonable fit between theory and experment could only be obtained by assuming in the theoretical calculations that the rooting density was 100 times smaller than that measured in the experiments. (See also W79-04348)(Skogerboe-Colorado State)
W79-04349

SEASONAL PATTERNS OF NUTRIENT MOVEMENT IN A FRESHWATER TIDAL MARSH,
Rider Coll., Trenton, NJ. Dept. of Biology.
R. L. Simpson, D. F. Whigham, and R. Walker.
In: Freshwater Wetlands: Ecological Processes and Management Potential, by Good, R.E., Whigham, D.F., and Simpson, R.L. p 244-257, 9 fig, 12 ref, 1978. Academic Press, N.Y. OWRT B-060-NJ(2), 14-34-0001-6099.

Descriptors: *Freshwater marsh, *Nutrients, Organic matter, Carbon dioxide, Dissolved oxygen, New Jersey, Nitrogen, Tidal effects, Decomposition, Algae.

The distribution and movement of dissolved O2, CO2, NO3-N and PO4-P in the surface waters of a freshwater tidal marsh were studied. Tidal action, particularly periodic inundation and flushing, resulted in distinctly different patterns of nutrient distribution in the major wetland habitats. Inorganic N and PO4-P were accumulated in the marsh during summer with emergent vegetation appearing to play an important role in the uptake and retention of nutrients. Although evidence is accumulating that some N and P may be translocated into belowground parts by several perennial macrophytes, most is rapidly leached after death of vascular plants with up to 80% of the total N and even more of the P lost within 1 month. In pond-like areas where filamentous algal blooms develop following the fall dieback of vascular plants, inorganic N and PO4-P levels remain depressed through the winter and spring. On the basis of available evidence, it appears almost all habitats of freshwater tidal marshes may be sinks for inorganic N and PO4-P during the vascular plant growing season and that certain habitats may continually function as sinks.
W79-04484

BIOMASS AND PRIMARY PRODUCTION IN FRESHWATER TIDAL WETLANDS OF THE MIDDLE ATLANTIC COAST,
Rider Coll., Trenton, NJ. Dept. of Biology.
D. F. Whigham, J. McCormick, R. E. Good, and R. L. Simpson.
In: Freshwater Wetlands: Ecological Processes and Management Potential, by Good, R.E., Whigham, D.F. and Simpson, D.F. p 3-20, 2 fig, 4 tab, 39 ref, 1978. Academic Press, NY. OWRT B-060-NJ(3), 14-34-0001-6099.

Descriptors: *Primary production, *Biomass, *Wetlands, *Freshwater marshes, Tidal waters.

Although there are many measurements of peak standing crop and several estimates of aboveground annual net production, there are few accurate estimates of total net primary production for Middle Atlantic coastal freshwater tidal wetlands. Estimates of biomass and production vary widely both within and between vegetation types. The variability appears to be due to sampling techniques and/or the heterogeneous nature of freshwater tidal wetland vegetation. Undoubtedly, all estimates of primary production are low because they do not include data on growing season mortality of plants and plant parts, herbivore consumption, and belowground production. Most estimates of primary production are also low because freshwater tidal wetland communities usually undergo a series of physiognomic changes during the growing season and the measurements of primary production do not account for those seasonal patterns. Comparatively, freshwater macrophyte production in tidal wetlands appears to be at least equal to that of brackish water wetlands at the same geographic latitude.
W79-04485

NITROGEN INPUTS TO STREAM WATER FROM FORESTS ALONG AN ELEVATIONAL GRADIENT IN NEW MEXICO,
New Mexico Univ., Albuquerque. Dept. of Biology.
J. R. Gosz.
Water Research, Vol 12, No. 9. p 725-734, 1978. 7 fig, 7 tab, 23 ref. OWRT-B-053-NMEX(3), 14-31-0001-50-95.

Descriptors: *Nitrogen, *Forests, *Runoff, Nutrients, Nitrogen compounds, Trees, Vegetation, Surveys, On-site investigations, Streams, Watersheds(Basins), Forest watersheds, Denitrification.

Studies of nitrogen inputs in precipitation and outputs in stream water for a number of terrestrial ecosystems supported the hypothesis that undisturbed communities leave the ability to reduce losses of nitrogen via stream water. In spite of different levels of biomass, productivity, and stream discharge for these communities, net losses of nitrogen were similar. Maintaining nitrogen in an organic or cation form (NH3, NH4 (+)) is an important factor in minimizing loss. This may be accomplished by slow rates of mineralization, rapid plant uptake, and denitrification through the electron sink pathway. Denitrification by the dissimilatory pathway also may be important. (Sims-ISWS)
W79-04498

2J. Erosion and Sedimentation

TRACE METAL RELATIONSHIPS IN BOTTOM SEDIMENTS OF A FRESH WATER STREAM--THE BUFFALO RIVER, ARKANSAS,
Arkansas Univ., Fayetteville. Dept. of Geology.
K. F. Steele, and G. H. Wagner.
Journal of Sedimentary Petrology, Vol. 45, No. 1, p 310-319, March 1975. 5 fig, 4 tab, 8 ref. OWRT A-025-ARK(2).

Descriptors: *Rivers, *Buffalo River, *Arkansas, *Trace elements, *Sediments, Bottom sediments, Sediment transport, Analytical techniques, Metals, Sediment load, Movement, Sedimentary rocks, Dolomite, Chert, Downstream, Upstream, Drainage area, Sampling.

A total of 77 sediment samples were taken from the lower 130 miles of the Buffalo River in Arkansas to chemically assess the present state of the river. The samples were acid extracted with aqua regia and analyzed by atomic absorption for Na, K, Mg, Ca, Fe, Mn, Ni, Cr, Cu, Cb, Cd, Co, Pb, and Zn. The elements Na, K, Mg, and Ca are related to the geology of the area; the remainder are potential pollutants, some of which are related to the area's mineralogy. Sixteen samples were dissolved by hydrofluoric acid techniques and analyzed by atomic absorption. A comparison of the trace elements thus obtained with the amounts obtained by aqua regia extraction showed that with the exceptions of sodium and potassium, aqua regia gave a high percentage of the total of each metal present. The downstream area showed a general decrease in Fe, Cu, Cr, Ni, Mn, Pb, K, and Na as the drainage area increased in carbonate rock and decreased in shale. Downstream sediments increased in Mg, Ca, Zn, and Cd. The sediments, quartz and chert grains, are coated with hydrous iron oxide which acts as a sorbent for most of the metals, and is a transport mechanism for acid extractable Co, Cr, Ni, Cu, Mn, and K. The other acid extractable metals are mostly in clastic grains. The acid extractable amounts of the drainage area ore metals, Zn, Pb, and Cu, in the sediments rise and fall with the extractable amounts of Ca plus Mg in the sediments indicating the presence of dolomite. (Davison-IPA)
W79-04017

EROSION, SEDIMENT DISCHARGE, AND CHANNEL MORPHOLOGY IN THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA. Water Resources Div.; and Geological Survey, Doraville, GA. Land Information Analysis.
R. E. Faye, W. P. Carey, J. K. Stamer, and R. L. Kleckner.
Geological Survey open-file report 78-576, 1978. 133 p, 46 fig, 31 tab, 41 ref.

Descriptors: *Georgia, *Sediment transport, *Sediment yield, *Suspended solids, *Erosion, Land use, Urbanization, *Agricultural runoff, Trace elements, Streamflow, Channel morphology, Turbidity, Nutrients, Geomorphology, Regulated flow, Streamflow-runoff relationships, Topography, *Upper Chattahoochee River basin.

Average annual rates of sheet erosion and sediment discharge were computed for several watersheds in the Upper Chattahoochee River basin in Georgia. Erosion yields ranged from about 900 to 6,000 tons per year per square mile in nine watersheds and were greatest where land use is largely agricultural or transitional. Suspended sediment yields from the same watershed ranged from about 300 to 800 tons per year per square mile and were greatest from urban areas and least from mostly forested watersheds. The impact of suspended sediment on stream quality was evaluated for 14 watersheds. In general, 60 percent or more of the total annual discharge of trace metals and phosphorus was contributed by suspended sediment. Yields of trace metals and nutrients in suspension were consistently greater in urban watersheds. Turbidity in basin streams increased geometrically with increasing concentrations of suspended sediment. (Woodard-USGS)
W79-04029

DREDGED MATERIAL RESEARCH PROGRAM, FOURTH ANNUAL REPORT.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 6G.
W79-04044

DYNAMICS OF WAVE-INDUCED CURRENTS IN SEDIMENTS,
Mississippi State Univ. Mississippi State. Dept. of Geology and Geography.
D. M. Keady.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 990, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute, Mississippi State University Report, October 1978. 23 p, 3 fig, 1 tab, 15 ref. OWRT A-999-MISS(13).

Descriptors: *Waves, *Bottom sediments, *Beds under water, Percolation, Darcys law, Water flow, Ripple marks.

The study involved observation of water motion induced by waves within sediments. Five sizes of sediments--small pebbles, granules, very coarse sand, coarse sand, and medium sand--were placed in a wave tank in such a manner that observations could be made in each segment as waves of similar characteristics passed over them. Dyes and near-neutral buoyant balls confined in channels were used to study the motion of the water. Pressure intensities were measured at the sediment-water interface at a fixed depth within each segment. Water movement in the three larger size sediments was readily observable and relative measures of the magnitude of the movements were obtained; water movement in the two smaller size sediments was negligible. The results of the laboratory studies and results from previous investigations indicate that the choice of theory to solve practical problems should be based on careful consideration of the magnitude of permeability, the compressibility of water, and the compressibility and cohesiveness of the grain skeleton.
W79-04076

FLOODING AND SEDIMENT TRANSPORT IN A SMALL ALPINE DRAINAGE BASIN IN COLORADO,
A. I. Mears.
Geology, Vol. 7, No. 1, p 53-57, January 1979. 3 fig, 2 tab, 10 ref.

Descriptors: *Small watersheds, *Floods, *Sediment transport, *Colorado, Watersheds(Basins), Alpine, Runoff, Boulders, Movement, Particle size, Bed load, On-site investigations, Analytical techniques, Mannings equation, Rational formula, Analysis, Floods.

A short-duration, high-intensity rainfall on a 0.43 sq km alpine drainage basin in the central Colorado mountains produced a peak discharge, including water and sediment, of 108 to 134 cu m/s. This exceeds by an order of magnitude the discharge of the 100-yr flood as predicted by the procedures recommended by the Soil Conservation Service and exceeds by a factor of two the largest discharge ever reported in a basin of similar size. The Manning formula and superelevation calculations were two methods used to compute velocities and discharges. These two methods depend upon independent sets of assumptions, but they produced similar results. Calculations of the fluid-dynamic stresses required to transport boulders in the upper channel also suggest flood formula and superelevation

tion calculations. In the lower channel, bed load moved as inertial grain flows. One flow studied in detail transported sediment onto a part of the alluvial fan not reached by deep flood water. The larger clasts were transported to the top and front of the grain flow. This type of sorting supports a theory of grain-flow deformation first suggested by Bagnold. Gran flows advancing at the velocities calculated in this paper can be potentially damaging to buildings located in their paths. (Humphreys-ISWS)
W79-04090

A LARGE-VOLUME INTERSTITIAL WATER SEDIMENT SQUEEZER FOR LAKE SEDIMENTS,
Maine Univ. at Orono. Dept. of Geological Sciences.
D. R. Sasseville, A. P. Takacs, S. A. Norton, and R. B. Davis.
Limnology and Oceanography, Vol. 19, No. 6, p 1001-1004, November 1974. 2 fig, 7 ref. OWRT-A-026-ME (4).

Descriptors: *Lake sediments, *Limnology, *Sediment yield, *Laboratory equipment, Costs, Filtration, Filters, Sieve analysis, Sampling, Water sampling, Bottom sampling, Separation techniques, Water quality.

A light weight, highly portable 800-CC interstitial water sediment squeezer which can process 75 ml/200 cc of sediment in 15 minutes is described. The sample does not come in contact with any metal, because all surfaces are Teflon coated. Because many parts are hardware stock and machining time is minimal, the cost is low. Detailed diagrams are provided. (Davison-IPA)
W79-04098

SUSPENDED SOLIDS CARRIED BY THE GALLATIN RIVER OF SOUTHWESTERN MONTANA: II. USING MINERALOGY FOR INFERRING SOURCES,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
M. G. Klages, and Y. P. Hsieh.
Journal of Environmental Quality, Vol. 4, No. 1, p 68-73, January-March, 1975. 3 fig, 3 tab, 12 ref. OWRT A-041-MONT(3).

Descriptors: *Suspended solids, *Gallating River(Montana), *Sediment transport, *Mineralogy, Silts, Clay, Quartz, Alluvium, Erosion, X-ray diffraction, Geology, Sampling, Deposition(Sediments), River basins, Watersheds(Basins), Tributaries.

Suspended sediment samples were taken from the Gallatin River and its tributaries from March to June in 1970 and 1971. Samples were taken from the lower valley after a snow or a rainstorm during March and April. The entire river system was sampled at two-week intervals during May and June regardless of precipitation. The silt and clay carried in suspension were examined by X-ray diffraction. The mineralogy of these suspended solids is related to geology of the eroding area. The variation in suspended sediments of the individual tributaries allowed the mineralogy to be used to infer the main source. Quartz yielded dominant diffraction peak in silts and smectic in clays. Taylor Fork, a tributary, was identified as the major source of suspended solids. The mineralogy of the silt and clay of this tributary resembled that carried by the river on 8 to 10 sampling dates. Alluvial materials eroded from the lower valley produced sediment with mineralogy similar to that presently carried by the river indicating that sediment sources have not changed much during recent geologic time. (See also W75-04501)(Davison-IPA)
W79-04099

UNIT SEDIMENT GRAPH,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
O. Rendon-Herrero.
Water Resources Research, Vol. 14, No. 5, p 889-901, October 1978. 12 fig, 3 tab, 23 ref.

Descriptors: *Unit hydrographs, *Watersheds(Basins), *Pennsylvania, Suspended sediment, Sediment transport, Sediment yield, Suspended load, Hydrographs, Hydrology, Graphical analysis, *Bixler Run(PA), *Sediment graph, Unit sediment graph.

The unit hydrograph method was extended to sediment graph analysis, thus yielding a unit sediment graph. The method is applicable to small uniform watersheds where the main contribution to suspended sediment transported in the drainage channels as the result of runoff derives from upslope erosion, that is, from wash load and not from entrained bed load material. Bixler Run, a small wash load-producing watershed near Loysville, Pennsylvania, was used as a data source in deriving unit sediment graphs. The hydrographs and concomitant sediment graphs used are generally parallel in shape and coincide during peak flow. (Lee-ISWS)
W79-04172

SUSPENDED SOLIDS IN WATER.
For primary bibliographic entry see Field 2L.
W79-04258

STUDY OF SEDIMENT GENERATION, TRANSPORT AND DEPOSITION IN SEMIARID ZONES,
Hebrew Univ., Jerusalem, Israel.
A. P. Schick.
Hydrological Sciences Bulletin, Vol. 22, No. 4, p. 535-542, Dec., 1977. 12 ref.

Descriptors: *Sediment control, *Sediment load, *Sediment distribution, *Sediment transport, *Sediment discharge, Channel erosion, Soil conservation, Silting, Silts, Erosion rates, Denudation, Stream erosion, Land management, Erosion control, Soil management, Water control, Arid lands, Reviews.

Sediment generation, transport and deposition in arid and semiarid regions of the world are problems complicated by the extremely variable precipitation and runoff characteristics of these areas. Additionally, the fragile environmental balance between erosion and conservation in arid regions is often upset by changes in climate, land use or technological impact. With the purpose of illustrating these problems and their potential solutions, this author presents a group of individual summaries by way of a general analysis, covering: (1) sediment transport in the Nile, (2) suspended load in the rivers of Northern Peru, (3) stream discharge, suspended sediment and erosion rates in the Red Deer River Basin of Alberta, Canada, (4) silting rates of reservoirs in Tunisia, (5) erosion from micro-catchments in the Sahel, and (6) erosion survey and evaluation of the Oued El-Hadjel Basin in Tunisia. The diversity and complexity of the problems discussed is apparent from the widely varying data reported on the concentration of suspended sediment (from 100 to 100,000 ppm) and on, mean annual denudation (from 10 to nearly 10,000 t km). It is this author's belief that past preoccupations with erosion rates should be replaced with a more comprehensive approach toward answering the questions of 'where from', 'where to', and 'how often'. (Tickes-Arizona)
W79-04301

SEDIMENTATION RATES IN LAKE CHAMPLAIN SINCE SETTLEMENT BY MAN,
Vermont Univ., Burlington. Dept. of Geology.
S. Hunt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 305, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center, University of Vermont Technical Completion Report, 1979. 24 p, 1 fig, 3 tab, 28 ref. OWRT A-033-VT(1).

Descriptors: *Sedimentation rates, *Lake Champlain, Ambrosia, Pollen dating.

Post-settlement sedimentation rates have been measured in twelve cores from Malletts Bay, eastern Lake Champlain, using pollen and diatom stratigraphy. A marked increase in Ambrosia pollen was observed in all cores studied. The data suggest deep water depositional rates in outer Malletts Bay of between .3 to 3 mm/yr. Sediment input into Malletts Bay is on the order of 28,800 metric tons a year which represents a denudation of 16 metric tons per square kilometer a year in the drainage basin. Study of two cores from central Lake Champlain revealed sedimentation rates of .6 mm/year and indicates the dating methods have widespread application.
W79-04308

HYDRAULICS IN THE COASTAL ZONE.
For primary bibliographic entry see Field 2L.
W79-04351

GROUNDWATER-SURFACE WATER RELATIONSHIP NEAR LAKE MICHIGAN SHORE,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2H.
W79-04371

VELOCITY DISTRIBUTION AND SEDIMENT MOTION INDUCED BY SHIP'S PROPELLER IN SHIP CHANNELS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-04374

EXPERIMENTAL STUDIES OF BEACH SCOUR DUE TO WAVE ACTION,
Korean Ocean and Research Development Inst., Seoul (South Korea).
For primary bibliographic entry see Field 2L.
W79-04386

TRANSPORTATION OF ORGANIC DETRITUS IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2L.
W79-04388

CHANNEL EROSION SURVEYS ALONG THE TAPS ROUTE, ALASKA 1977,
Geological Survey, Anchorage, AK. Water Resources Div.
R. M. Loeffler, and J. M. Childers.
Geological Survey open-file report 78-611 (basic data), 1977. 88 p, 49 fig, 9 ref.

Descriptors: *Channel erosion, *Alaska, *Pipelines, *Photogrammetry, *Remote sensing, Data collections, Scour, Construction, Bank erosion, Streamflow, Flood plains, Melt water, Streambeds, Erosion, Evaluation, *Trans-Alaska pipeline system(TAPS).

Channel surveys were made along the trans-Alaska pipeline system (TAPS) route during 1977 at the same 28 sites that were studied in 1976. In addition, a new site at pipeline mile 22 near Deadhorse (alignment No 134) along the Sagavanirktok River was put under surveillance. Except for changes wrought by the completion of construction, most of the sites showed very little change. Significant events include virtual completion of all construction activities along the pipeline, the pipeline startup, and the breakup flood along the Sagavanirktok River which breached many river-training structures. In general, 1977 saw heavy flooding on streams draining the north and south slopes of the Brooks Range and only moderate flooding on streams further south. Aerial photogrammetric surveys were used again in 1977 on the same seven sites as in 1976. Results document the applicability of the method for channel erosion studies. (Woodard-USGS)
W79-04411

STATE V. BEACH COMPANY (SPORADIC, RECREATION USE OF PRIVATE BEACH-FRONT LAND NOT SUFFICIENT TO CREATE PUBLIC EASEMENT TO BEACH).
248 S. E. 2d 115-20 (S.C. 1978).

Descriptors: *Prescriptive rights, *South Carolina, *Public access, *Beaches, Easements, Oceans, Islands, State jurisdiction, Properties, Construction, Accretion(Legal aspects), Land development.

The state of South Carolina brought an action against the corporate owners of island property, alleging that certain rights of the public to use a beachfront area on the island had been intruded upon by the defendants. The state sought to enjoin the development of the property. The trial court determined that there had been a dedication of a certain portion of the property to the public by way of continued public use. However, on appeal, the South Carolina Supreme Court held that the general public did not acquire a permanent easement or prescriptive right of use that could operate to effectively prohibit the sale or development of the property by the owner of the fee simple title where no dedication could be proven by plat or other written instrument. Further, no dedication could be implied from the permissive, sporadic and recreational use which had occurred here. The court also stated that where the land owned by defendants had been subjected to accretion by natural alluvial action, then the owner's title extended to the increased land resulting from the accretion. (Hucks-Florida)
W79-04429

DRAWING THE LINE AT THE OCEANFRONT: THE ROLE OF COASTAL CONSTRUCTION SETBACK LINES IN REGULATING DEVELOPMENT OF THE COASTAL ZONE,
Spessard L. Holland Law Center, Gainesville, FL.
F. E. Maloney, and A. J. O'Donnell, Jr.
Univ. of Fla. Law Review, Vol. 30, No. 2, p 383-418, Winter 1978.

Descriptors: *Beaches, *Florida, *Construction, *Environmental control, Permits, Coastal engineering, Environmental effects, Beach erosion, Regulation, Water pollution, Land development.

In recent years there has been a marked increase in real estate development. This rapid and largely unrestrained growth has resulted in increased public awareness and concern over potential environmental impact. Public concern is especially keen in Florida where coastal lands are of crucial economic importance to the state. The state legislature and state administrative agencies have attempted to enact measures to regulate developments of regional impact, protect ecologically critical areas and promote comprehensive and environmentally sound land use planning throughout the state. One popular method of regulating coastal development, the use of construction setback lines, is examined here in detail. Setback lines establish a strip of land next to the water on which no construction is permitted. Setback lines have been used by both the state and local communities as a means of protecting and preserving the coastline. A model ordinance, which utilizes setback lines and construction permits to minimize the adverse environmental impact of coastal development, is offered. The background of similar ordinances in Florida is examined. (Hucks-Florida)
W79-04432

STATE LAW, NOT FEDERAL, DETERMINES RIPARIAN RIGHTS TO ACCRETIONS,
For primary bibliographic entry see Field 6E.
W79-04450

2K. Chemical Processes

THE COMPLEXING AND ADSORPTION OF CADMIUM IN SOILS IN THE PRESENCE OF EDTA AND NTA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5B.
W79-04007

CONTENTS OF SOME HEAVY METALS IN NORWEGIAN RIVERS,
Institutt for Atomenergi, Kjeller (Norway). Isotope Labs.
For primary bibliographic entry see Field 5A.
W79-04021

A STUDY OF LOUISIANA'S MAJOR ESTUARIES AND ADJACENT OFFSHORE WATERS,
Louisiana Wildlife and Fisheries Commission, New Orleans.
For primary bibliographic entry see Field 2L.
W79-04156

GREENHOUSE EVALUATION OF RESIDUAL PHOSPHATE BY FOUR PHOSPHORUS METHODS IN NEUTRAL AND CALCAREOUS SOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
R. A. Bowman, S. R. Olsen, and F. S. Watanabe.
Soil Science Society of America Journal, Vol. 42, No. 3, p 451-454, May-June, 1978. 3 fig, 3 tab, 32 ref, 2 equ.

Descriptors: *Phosphorus, Chemical analysis, *Soil chemical properties, Calcareous soils, Carriers, Greenhouses.

Four determinations of phosphorus--Olsen-P, Colwell-P, total exchangeable P, and resin-extractable P--were evaluated in terms of total plant P uptake in a 3-year continuous greenhouse study of 23 high P calcareous and neutral soils. All methods were highly correlated with total P taken up from the soils by 5-8 successive greenhouse crops. The Olsen-P procedure extracted an average of nearly 50% of the total plant P while the Colwell procedure extracted nearly 80%. Resin-extractable P and total exhangeable P values approximated the total plant P uptake, and served as good biological measures of the total plant-available P in the soil. No significant differences were observed between the carrier and carrier-free 32P methods on the 23 test soils. (Skogerboe-Colorado State)
W79-04178

DEVELOPMENT OF A DTPA SOIL TEST FOR ZINC, IRON, MANGANESE, AND COPPER,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
W. L. Lindsay, and W. A. Norvell.
Soil Science Society of America Journal, Vol. 42, No. 3, p 421-428, May-June 1978. 4 fig, 7 tab, 31 ref.

Descriptors: *Chelation, *Soil tests, *Spectrophometry, Nutrients, Fertilizers, Sweet corn, Sorghum, Colorado, DTPA test, Zinc, Iron, Manganese, Copper.

A DTPA soil test was developed to identity near-neutral and calcareous soils with insufficient available Zn, Fe, Mn, or Cu for maximum yields of crops. The extractant consists of 0.005M DTPA, 0.1M triethanolamine, and 0.01M CaC12, with a pH of 7.3 The soil test successfully separated 77 Colorado soils on the basis of crop response to Zn, Fe, and Mn fertilizers. Development of the soil test was based, in part, on theoretical considerations. The extractant is buffered at pH 7.30 and contains CaC12 so that equilibrium with CaC03 is established at a C02 level about 10 times that of the atmosphere. Thus, the extractant precludes dissolution of CaC03 and the release of occluded nutrients which are normally not available to plants. DTPA was selected as the chelating agent because it can effectively extract all four micronutrient metals. Factors such as pH, concentration of chelating agent, time of shaking, and temperature of extraction affect the amount of micronutrients extracted and were adjusted for maximum overall effectiveness. (Skogerboe-Colorado State)
W79-04179

EFFECTS OF SOLUTION CHEMISTRY AND ENVIRONMENTAL CONDITIONS ON AMMONIA VOLATILIZATION LOSSES FROM AQUEOUS SYSTEMS,
International Fertilizer Development Center, Florence, AL. Agro-Economic Div.
P. L. G. Vlek, and J. M. Stumpe.
Soil Science Society of America Journal, Vol. 42, No. 3, p. 416-421, May-June, 1978. 5 fig, 1 tab, 17 ref, 7 equ.

Descriptors: Nitrogen, *Ammonia, Volatility, Rice, Fertilizers, Aqueous solutions, Kinetics.

Laboratory studies were conducted to explain the wide variation in reported estimates of ammonia volatilization losses from N-fertilized paddy fields. The ammonia volatilization capacity of a system was found to be equivalent to its alkalinity. In solutions lacking alkalinity, loss of (NH4)2SO4 was limited, whereas loss of (NH4)2CO3 was essentially complete. Ammonia loss from solution is best described as a consecutive reaction with opposing step. Ammonia volatilization per se followed first-order reaction kinetics. The rate of ammonia volatilization is thus directly related to the concentration of aqueous ammonia and therefore to the concentration of ammoniacal N and pH. The rate of ammonia volatilization was severely restricted by limiting the movement of air above the water, as is often the case in the laboratory and field studies reported to date. Ammonia volatilization was enhanced by water turbulence and increased exponentially with temperature from almost nil at O C to approximately 20 mg N/100 sq cm/5 hours at 46C. (Skogerboe-Colorado State)
W79-04180

SURFACE CHARGE MANIPULATION OF CONSTANT SURFACE POTENTIAL SOIL COLLOIDS: I. RELATION TO SORBED PHOSPHORUS,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
S. S. Wann, and G. Uehara.
Soil Science Society of America Journal, Vol. 42, No. 4, p. 565-570, July-August, 1978. 7 fig, 4 tab, 20 ref, 7 equ.

Descriptors: *Colloids, Phosphorus, *Cation adsorption, Cation exchange, Soil management, *Soil chemistry.

A significant correlation was found between the zero point of charge and the quantity of phosphorus applied to soil material from an Oxisol. Sorbed phosphorus lowered the zero point of charge and increased surface charge density at any pH above the zero point of charge. The soil was treated with 0, 100, 500, and 1,500 ppm P as (NH4)2HPO4. For the soil with no added phosphorus, low concentration of monovalent electrolyte and within two pH units of the zero point of charge, diffuse layer theory adequately predicted surface charge. For high electrolyte concentration and high pH, the Stern theory with specific adsorption energy predicted the experimental results. The calculated results indicated charge reversal in the high-phosphorus samples. (Skogerboe-Colorado State)
W79-04203

FACTORS AFFECTING DENITRIFICATION IN A SONORAN DESERT SOIL,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
R. L. Westerman, and T. C. Tucker.
Soil Science Society of America Journal, Vol. 42, No. 4, p. 596-599, July-August, 1978. 4 fig, 3 tab, 6 ref.

Descriptors: *Denitrification, Nitrogen, Temperature, Moisture content, Time, Arid climates, *Deserts, Carbon, Depth.

Incubation studies were conducted to determine the effect of temperature, moisture content, organic C, soil depth, and time on transformations of added 15NO3(-N) to a Sonoran Desert soil in open and closed systems. In open system studies, increasing temperature from 20 to 37C, adding or-

ganic C, and increasing moisture content from field capacity to saturation increased denitrification losses 16, 22, and 2%, respectively. There were no apparent differences in immobilization of 15NO3(-N) due to temperature, time, moisture content, or soil depth without organic C amendments. However, immobilization of 15NO3(-N) soils with organic C amendments was increased markedly with increased temperature and time, but initial moisture content had little effect. At C/N ratios of 150:1 only traces of 15N appeared in NH4(-N), however, at C/N ratios of 15:1 to 45:1 ammonification and immobilization occurred simultaneously. Closed system investigation with organic C and 15NO3(-N) amendments showed 79% loss in 5 days with the remaining 21% accumulating as organic-15N. Denitrification losses in open systems with soil moisture contents representative of saturated conditions were 70% of the loss observed under closed systems at the same moisture content. (Skogerboe-Colorado State)
W79-04204

PHOSPHATE DESORPTION FROM KAOLINITE SUSPENSIONS,
Volcani Inst. fo Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
B. Bar-Yosef, and U. Kafkafi.
Soil Science Society of America Journal, Vol. 42, No. 4, p 570-574, July-August, 1978. 5 fig, 2 tab, 18 ref, 2 equ.

Descriptors: *Phosphates, *Kaolinite, Activation energy, Hysteresis.

The objective of this work was to study the effect of the desorption method used, equilibration time and the dissolved silica on the desorption of P from kaolinite. Two desorption methods were used: (1) diluting 1% suspensions by various volumes of the same electrolyte, and (2) immersing a dialysis tube containing 0.25% suspension(+P) in an identical suspension initially free of P. The desorption process in both cases could be divided into a rapid and a slow first-order reaction. The rapid reaction rate constant was similar in both systems (about 4.5 x 0.001/hour at 25C). The slow reaction constants were 0.3 x 0.001/hour and 1.15 x 0.001/hour for cases (1) and (2), respectively. The activation energy of the desorption process in case (2) was 16.2 Kcal/mole for the rapid and 4.8 Kcal/mole for the slow reaction. The amount of silica dissolved from kaolinite due to dilution with 0.01M KCl depended on the dilution ratio and reached 16 mg SiO2/g kaolinite when the suspension was diluted 100-fold. Readsorption of part of the dissolved silica is stipulated to contribute to the fast P desorption process. (Skogerboe-Colorado State)
W79-04207

PREDICTION OF PHOSPHORUS DIFFUSION FROM FERTILIZER SOURCE,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
G. S. Hira, and N. T. Singh.
Soil Science Society of America Journal, Vol. 42, No. 4, p 561-565, July-August, 1978. 7 fig, 2 tab, 11 ref, 11 equ.

Descriptors: *Phosphorus, Diffusion, Fertilizers, Adsorption, Isotherms, *Soil chemistry.

Rate of P diffusion from fertilizer applied at the soil surface was studied using Fick's law of diffusion. The diffusion coefficient of P was determined from a knowledge of the tortuosity factor and P adsorption isotherm. Phosphorus diffusion coefficient calculated from Nye's equation did not prove suitable at very low or high concentration of P at the soil surface. The phosphorus diffusion coefficient calculated from experimental data increased linearly with the square root of P concentration applied at the source. Predicted P concentration-distance profiles were very close to the experimental values estimated by employing a sectioning technique. (Skogerboe-Colorado State)
W79-04208

THERMODYNAMICS OF POTASSIUM-CALCIUM AND MAGNESIUM-CALCIUM EXCHANGE REACTIONS ON A KAOLINITIC SOIL CLAY,
Ibadan Univ. (Nigeria) Dept. of Agronomy.
E. J. Udo.
Soil Science Society of America Journal, Vol. 42, No. 4, p 556-560, July-August, 1978. 2 fig, 3 tab, 22 ref, 15 equ.

Descriptors: *Thermodynamics, *Cation exchange, Kaolinite, Potassium, Calcium, Magnesium, Adsorption, Isotherms, Selectivity, *Soil profiles.

Thermodynamic parameters derived from experimental results were determined for the potassium-calcium and magnesium-calcium exchange reactins on a kaolinitic soil clay separated from the B horizon of a strongly weathered soil profile. The clay samples were equilibrated at 10 and 30C with a mixed solution of KCl and CaCl2 for the K-Ca system or MgCl2 and CaCl2 for the Mg-Ca system. For the K-Ca system, the selectivity coefficients were high indicating a greater affinity of the clay for K than for Ca. The high equilibrium constant and the negative values of standard free energy and enthalpy changes for the exchange of Ca for K also revealed a preference of the clay for K relative to Ca ions. In the Mg-Ca system, the exchange isotherms and the low selectivity coefficients indicated a preference of Ca ions for the clay phase. This exchange of Ca for Mg was accompanied by an increase in the free energy and enthalpy changes also pointing to a more stable Ca-clay than Mg-clay. (Skogerboe-Colorado State)
W79-04209

COPPER AND CADMIUM ADSORPTION CHARACTERISTICS OF SELECTED ACID AND CALCAREOUS SOILS,
Cornell Univ. Agricultural Experiment Station, Ithaca, NY. Dept. of Agronomy.
N. Cavallaro, and M. B. McBride.
Soil Science Society of America Journal, Vol. 42, No. 4, p 550-556, July-August, 1978. 9 fig, 2 tab, 27 ref.

Descriptors: *Heavy metals, *Copper, *Cadmium, *Cation adsorption, Ion exchange, Acidic soils, Calcareous soils, Soil chemistry.

Samples of two New York soils, an acid and a neutral silt loam, were equalibrated with Cu(2+) and Cd(2+) solutions in concentrations ranging from 0.00001 to 0.0001 M in distilled water and in 0.01M CaC12. The extent of complexation and adsorption of the heavy metals was measured using specific electrodes and atomic absorption. The data were found to fit the Langmuir adsorption model, and the Cu(2+) adsorption maxima were greater than those of Cd(2+) for both soils. Acid soils demonstrated much less ability to retain the heavy metals than neutral soils. In the presence of 0.01M CaC12, adsorption of the metals was much reduced, suggesting Ca(2+) competition for adsorption sites. A considerable amount of Cu(2+) was complexed in the soil solutions, but Cd(2;) complexation was much less evident. The results support an ion exchange mechanism of adsorption in the surface soils, and suggest that precipitation occurs in calcareous subsoils. (Skogerboe-Colorado State)
W79-04210

ATRAZINE MOBILITY IN TWO SOILS UNDER CONVENTIONAL TILLAGE,
Pennsylvania Agricultural Experiment Station, University Park. Dept. of Soil Chemistry and Weed Science.
For primary bibliographic entry see Field 2G.
W79-04212

IMPORTANCE OF THE ORGANIC PHOSPHORUS FRACTION IN EXTRACTS OF CALCAREOUS SOIL,
Cotton Research Center, Phoenix, AZ.
J. L. Abbott.
Soil Science Society of America Journal, Vol. 42, No. 1 p 81-85, January-February, 1978. 2 fig, 8 tab, 10 ref.

Descriptors: *Soil analysis, Calcareous soils, *Phosphorus, Forage sorghum, *Fertilizers, Organic compounds, Soil chemistry.

Laveen clay loam soil samples were collected immediately following the harvest of forage sorghum (Sorghum bicolor (L.) Moench). Two sets were prepared before growing turnips (Brassico rapa L.) as the test crop in the greenhouse. One set was without treatment and the other, to simulate winter and spring conditions, was incubated for 20 days after addition of N and dextrose. Phosphorus uptake by turnips and changes in soil P forms were positively correlated with corresponding measurements taken during the growth of the sorghum crop. Correlations among P uptake by forage sorghum, turnips, and soil P measurements indicated their value in predicting available P. Prediction values for two of the procedures were improved by including the extractable organic P with the inorganic P for the incubated soil. Results showed that (1) time of sampling, (2) the crop to be grown, (3) the method of extraction, and (4) the means of converting organic P to a measureable inorganic form in the extract are of prime concern in deciding when to include extractable organic P in the P evaluation of a given soil. (Skogerboe-Colorado State)
W79-04213

THE DISTRIBUTION OF MICRONUTRIENT CATIONS IN SOIL UNDER CONDITIONS OF VARYING REDOX POTENTIAL AND PH,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
J. L. Sims, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 42, No. 2, p 258-262, March-April, 1978. 5 tab, 19 ref.

Descriptors: Iron, Manganese, Zinc, Copper, *Organic matter, *Nutrient removal, Flooding, Toxicity, *Hydrogen ion concentration.

A laboratory study was conducted to determine the influence of redox potential and soil pH on the distribution of Fe, Mn, Zn, and Cu in Mhoon silty clay loam soil (Tupic Fluvaquents) and to provide insight into factors affecting micronutrient dissolution and mobility in soil. Generally, greater amounts of Fe, Mn, Zn, and Cu were found in the Na acetate (exchangeable) and pyrophosphate (organic) extractions at low pH and Eh than at high pH or Eh. In contrast, the amounts (except Mn) in the water-soluble, NH20H.HC1, and oxalate fractions were greater at high pH or Eh. Although the micro-nutrients were brought into solution at low pH and Eh, much of the soluble cations soon associated with the exchangeable and organic fractions. After reduction, mobilized Fe associated about equally with the exchangeable, organic, and NH20H.HC1 fractions; immobilized Mn with the exhangeable and water-soluble fractions; mobilized Zn with the organic fraction; and the mobilized Cu with the organic and water-soluble fractions. Separation of the water-soluble fraction into free ions and those complexed by soluble organic matter indicated that micronutrient cations were complexed by organic matter to a greater extent in reduced soil. (Skogerboe-Colorado State)
W79-04214

FATE OF FERTILIZER NITRATE APPLIED TO COASTAL BERMUDAGRASS ON A SWELLING CLAY SOIL,
Agricultural Research Service, Temple, TX. Blackland Conservation Research Center.
D. E. Kissel, and S. J. Smith.
Soil Science Society of America Journal, Vol. 42, No. 1, p. 77-80, January-February, 1978. 3 tab, 16 ref.

Descriptors: Nitrates, Denitrification, Fertilizers, Bermudagrass, Soil physical properties.

The disposition of N fertilizer applied to Coastal bermudagrass in the field over two growing seasons was determined by applying 560 kg N/ha as Ca(NO3)2 tagged with 7.599 atom % 15N to a

field microplot during 1974 and measuring various components of the N balance. Plant uptake of residual N was measured during 1975. Forty-nine percent of the applied N was recovered in harvested forage in 1974. About 40% of the applied N remained in the soil as residual N at the end of 1974. About 10% of the N was unaccounted for, indicating that denitrification losses were no more than 10% of the applied N. Most of the residual N at the end of the first growing season was immobilized N or was present in the root system of the grass. Immobilization is, therefore, a major factor causing low recovery of applied N by Coastal bermudagrass on swelling clay soils. Moreover, since only 17% of the residual N was recovered in forage during 1975 (7% of the N applied in 1974), most of the immobilized N was not available the following year. (Skogerboe-Colorado State)
W79-04215

POTASSIUM AND RUBIDIUM ADSORPTION AND DIFFUSION IN SOIL,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
V. C. Baligar, and S. A. Barber.
Soil Science Society of America Journal, Vol. 42, No. 2, p. 251-254, March-April 1978. 2 fig, 4 tab, 10 ref, 6 equ.

Descriptors: *Cation adsorption, Cation exchange, *Potassium, Cations, Diffusion, Correlation analysis, Organic matter, *Ribidium.

The adsorption of K and Rb by four soils was investigated to determine the differences in adsorption of K and Rb which may occur and how they are affected by soil properties with the view of using this information to evaluate the uptake mechanisms for K and Rb by plant roots growing in soil. Rubidium was adsorbed preferentially to K by all four soils. Selectivity coefficient k sub Rb/K, indicating the size of the effect ranged from 1.9 to 4.4. Adding K decreased k sub Rb/K, increased the amount of nonexchangeable Rb and decreased exchangeable Rb. There was a negative correlation (coefficient of determination = 0.78) between exchangeable K in the soil and k sub Rb/K. The level of K in the soil had a greater effect on k sub Rb/K than varying types of exchange sites present due to differences in clay and amount of organic matter in the four soils investigated. The size of the selectivity coefficient indicated that the difference between K/Rb ratios in the solution and exchange phases of these soils used and differences between soils made them suitable for use in plant uptake studies of the mechanisms of K and Rb uptake. (Skogerboe-Colorado State)
W79-04216

ADSORPTION OF ALDICARB BY CLAYS AND SOIL ORGANO-CLAY COMPLEXES,
Texas A and M Univ., College Station. Dept. of Soil and Crop Science.
J. R. Supak, A. R. Swoboda, and J. B. Dixon.
Soil Science Society of America Journal, Vol. 42, No. 2, p 244-248, March-April, 1978. 3 fig, 3 tab, 22 ref.

Descriptors: Carbamate pesticides, Systemics, Insecticides, *Adsorption, Montmorillonite, Illite, Kaolinite, *Clay minerals.

Adsorption experiments conducted with S-methyl-14C-aldicarb resulted in what appeared to be negative adsorption (exclusion) of the toxicant on Ca- and Al- saturated montmorillonite clays. Calculated exclusion volumes indicated that aldicarb did not penetrate the interlamellar region. Aldicarb was excluded from at least the first 16 layers of water on external surfaces of montmorillonite. Positive adsorption occurred with Ca- and Al-saturated illite and kaolinite clays. Equilibration of aldicarb solutions with one acid and two calcareous Vertisols, and with the organo-clay complexes isolated from these Vertisols, produced negative adsorption isotherms for the acid and positive adsorption isotherm for calcareous adsorbents. (Skogerboe-Colorado State)
W79-04217

MULTICOMPONENT CATION ADSORPTION DURING CONVECTIVE-DISPERSIVE FLOW THROUGH SOILS: EXPERIMENTAL STUDY,
Utah State Univ., Logan. Dept. of Soils and Biometeorology.
S-H. Lai, J. J. Jurinak, and R. J. Wagenet.
Soil Science Society of America Journal, Vol. 42, No. 2, p 240-243, March-April, 1978. 5 fig, 14 ref, 2 equ.

Descriptors: *Cation adsorption, Cation exchange, *Soil water movement, Solutes, Sodium, Magnesium, Calcium, Isotherms.

The adsorption of H(+), Mg(2+), and Ca(2+) from aqueous solutions flowing through soil was examined under different total cation concentrations and input pulse volumes. The pulses of H(+) and Mg(2+), which were introduced into a Ca(2+)-saturated Yolo loam soil column, appeared separately in the effluent. The degree of separation decreased with total concentration, but was not affected significantly by the pulse volume. At constant total concentration, the initial appearance of the H(+) pulse in the effluent was not affected by input volume; the appearance of the Mg(2+) pulse was delayed with increasing pulse volume. The experimental results were compared to theoretical calculations based on a single component linear equilibrium model. At a low loading (a small amount of adsorbate with respect to a large amount of adsorbent), the agreement of the theoretical model and the experimental results was satisfactory. However, when the loading was increased, the discrepancy between the calculated values and the experimental results increased. (Skogerboe-Colorado State)
W79-04218

DISPOSITION OF 15N-LABELED FERTILIZER NITRATE APPLIED DURING CORN CULTURE IN FIELD LYSIMETERS,
Science and Education Administration, Temple, TX. Grassland-Forage Research Center.
For primary bibliographic entry see Field 3F.
W79-04223

THE AUTOMATIC DETERMINATION OF PPB LEVELS OF AMMONIA, NITRATE PLUS NITRITE, AND PHOSPHATE IN WATER IN THE PRESENCE OF ADDED MERCURY (II) CHLORIDE,
Commonwealth Scientific and Industrial Research Organization, St. Lucia (Australia). Div. of Soils.
J. O. Skjemstad, and R. Reeve.
Journal of Environmental Quality, Vol. 7, No. 1, p 137-141, January-March, 1978. 4 fig, 3 tab, 17 ref.

Descriptors: *Ammonia, *Nitrates, Nitrites, *Phosphates, Preservation, Chemical analysis.

Three automated procedures are reported for the simultaneous determination of ammonia, nitrate plus nitrite, and phospate in water. The ammonia determination is based on the salicylate-dichloroisocyanurate reaction in the presence of nitroprusside preceded by in-line distillation. Nitrate plus nitrite is estimated by using an in-line copperized cadmium reductor, diazotizing the nitrite with sulphanilamide, and coupling with N-1-naphtylethylenediamine. Phosphate is estimated by reaction with molybdate and reduction to molybdenum blue with ferrous ammonium sulphate. Mercury (II) chloride used as a preservative does not interfere with the methods and good precision at ppb levels can be obtained. (Skogerboe-Colorado State)
W79-04226

A NEW APPROACH TO SOIL TESTING: III. DIFFERENTIAL ADSORPTION OF POTASSIUM,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
W. L. Stout, and D. E. Baker.
Soil Science Society of America Journal, Vol. 42, No. 2, p 307-310, March-April, 1978. 1 fig, 7 tab, 17 ref, 10 equ.

Descriptors: *Soil tests, *Potassium, Cation adsorption, Nutrient requirements, Cation exchange, *Soil chemical properties, Regression analysis.

Donnan type ratios were used to develop an index to account for the differential adsorption of K in two widely differnt soils of the Rayne and Hublersburg series. This index was used to calculate and adjusted K requirement for the soils using the approach of Baker. Three corn hybrids (Zea mays L.) were grown in the two soils reated with different level of K and multiple regression analysis was used to relate soil test varibables to plant K content. Most of the variation in the index, K sub E/S, was associated with soil effects, making the index useful in characterizing the two soils with respect to differential K adsorption and in calculating soil K requirements. Over 60% of the variation in plant K content was explained by the soil K requirement calculated from he index. Compared with a critical K level of 98 ppm exchageable K for soils with a CEC of 10 mez/100 g and a K sub E/S of 1.0, the comparable critical values for K were 71 ppm for the Rayne and 114 ppm for the Hublersburg. (See W74-08281). (Skogerboe-Colorado State)
W79-04227

COLORIMETRIC DETERMINATION OF UREA IN SOIL EXTRACTS USING AN AUTOMATED SYSTEM,
Melbourne Univ., Parkville (Australia). Faculty of Agriculture and Forestry.
L. A. Douglas, H. Sochtig, and W. Flaig.
Soil Science Society of America Journal, Vol. 42, No. 2, p 291-292, March-April, 1978. 1 fig, 1 tab, 2 ref.

Descriptors: *Ureas, Colorimetry, Analytical techniques, Inhibitors, *Soil tests, Automation.

A method is described for using an automated system to determine urea in 2M KCl soil extracts that contain a urease inhibitor (phenylmercuric acetate). The method is sensitive and precise and allows 90-120 extracts to be analysed per day. (Skogerboe-Colorado State)
W79-04228

INHIBITION OF UREASE ACTIVITY BY HETEROCYCLIC SULFUR COMPOUNDS,
Alberta Univ., Edmonton. Dept. of Soil Science.
W. D. Gould, F. D. Cook, and J. A. Bulat.
Soil Science Society of America Journal, Vol. 42, No. 1, p 66-71, January-February, 1978. 3 fig, 5 tab, 30 ref.

Descriptors: *Urea, Nitrogen, *Nitrification, Inhibitors, Sulfur compounds, Volatility, Hydrolysis, Soil investigations.

The inhibition of both jack bean urease and soil urease by several heterocyclic mercaptans was investigated. The following compounds not previously tested as urease inhibitors were found to be effective inhibitors of jack bean urease: 1,3,4-thiadiazole-2,5-dithiol; 5-mercapto-3-phenyl-1-1,3,4-thiadiazole-2-thione; and 5-amino-1,3,4-thiadiazole-2-thiol. The disulfides of the latter two compounds were found to be very potent inhibitors of jack bean urease. The results are consistent with an inhibition mechanism involving a thiol-disulfide exchange reaction between a disulfide and one or more of the sulfhydryl groups of urease. The results also imply that inhibition of urease by the heterocyclic mercaptans was due to trace amounts of the corresponding disulfides or polysulfides in the mercaptan preparations. A number of heterocyclic mercaptans, two disulfides, and a number of known urease inhibitors were evaluated as soil urease inhibitors, and the following compounds were the most effective: 1,4-benzoquinone; hydroquinone > 2,5-dimethyl-1-1,4-benzoquinone; catechol; 1,3,4-thiadiazole-2,5-dithiol; 2,6-dimethyl-1,4benzoquinone. (Skogerboe-Colorado State)
W79-04233

A NEUTRON ACTIVATION METHOD FOR DETERMINING SUBMICROGRAM SELENIUM IN FORAGE GRASSES,

Missouri Univ.-Columbia. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W79-04235

EXTRACTABILITY OF 238PU AND 242CM FROM A CONTAMINATED SOIL AS A FUNCTION OF PH AND CERTAIN SOIL COMPONENTS: HNO3-NAOH SYSTEM,
California Univ., Los Angeles, Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 2G.
W79-04236

GEOCHEMISTRY OF GEOPRESSURED GEOTHERMAL WATERS FROM THE TEXAS GULF COAST,
Geological Survey, Menlo Park, CA. Water Resources Div., and Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 1A.
W79-04414

2L. Estuaries

CARBON REQUIREMENTS OF A POPULATION OF THE ESTUARINE COPEPOD EURYTEMORA AFFINIS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. R. Heinle, and D. A. Flemer.
Marine Biology, Vol. 31, p 235-247, 1975. 6 fig, 6 tab, 56 ref. OWRT B-014-MD(2).

Descriptors: *Algae, *Microorganisms, *Patuxent River, *Maryland, *Eurytemora affinis, Nutrient requirements, Carbon, Estuarine environment, Biomass, Sampling, Measurement, Aquatic microorganisms, Copepods.

The carbon requirements of Eurytemora affinis produced in the Patuxent River estuary (Maryland) are reported. The general features and physical characteristics of the study area are described, and the methods and materials used are discussed. Total carbon concentrations decreased at the upstream stations and increased at the downstream stations during this study. Productivity of the E. affinis was measured and was found to approximate expected productivity. Low productivity in the downstream populations were the result of low proportions of egg-bearing females, while low productivity rates at upstream stations were due to limited food supply. E. affinis carbon demand was calculated from population biomass, and productivity measured as a rate of production of eggs. The carbon demand of E. affinis exceeded gross primary production by 2 to 75-fold from March through May at some stations. The greatest carbon demand in excess of algal production occurred during April. It is estimated that the detrital (non-algal and non-copepod) carbon is used to meet part of the energy requirements of E. affinis during March, April, and May. Turnover times, calculated for all occasions when carbon demand exceeded primary production, were between 8 and 83 days. It was assumed that all primary production was consumed by E. affinis. (Davison-IPA)
W79-04011

DREDGED MATERIAL RESEARCH PROGRAM, FOURTH ANNUAL REPORT.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 6G.
W79-04044

UPPER LAYER OBSERVATIONS AND SIMULATION USING KRAUS AND TURNER'S MODEL IN THE GULF OF FINLAND,
Helsinki Univ. (Finland). Dept. of Geophysics.
M. Tyrvainen.
Nordic Hydrology, Vol. 9, No. 3/4, p 207-218, 1978. 9 fig, 3 tab, 8 ref.

Descriptors: *Temperature, *Water temperature, *Thermocline, *Model studies, Mathematical models, Mixing, Radiation, Solar radiation, Heat transfer, Winds, Humidity, Clouds, On-site data collections, Sampling, Oceanography, Estuaries, *Finland, *Gulf of Finland.

There are strong seasonal variations in the depth of the thermocline and in the sea surface temperature in the western part of the Gulf of Finland. A numerical model was used to calculate the depth of the thermocline and the temperature of the mixed layer from June to October in 1969 and 1974. Observed daily mean values of total incoming radiation, air temperature, wind velocity, air humidity, and cloudiness were used as input data from which the thermal energy balance on the sea surface was calculated. The model is sensitive to the drag coefficient of the wind and to the absorption coefficient of the solar radiation for which the values c sub D = 0.0008 and Beta = 0.25/m were used. For the mixed layer temperature, the results of the model are 2-4 deg C too small. The depth of the thermocline can be predicted with an accuracy of + or -5 meters. (Sims-ISWS)
W79-04045

MIXING IN SHALLOW COASTAL SEA: CASE STUDY,
New Jesey Dept. of Environmental Protection, Trenton. Delaware River Water Quality Planning.
For primary bibliographic entry see Field 5B.
W79-04049

FORAMINIFERA, DIATOM AND BIVALVE DISTRIBUTION IN RECENT SEDIMENTS OF THE HUDSON ESTUARY,
City Coll., New York. Dept. of Earth and Planetary Sciences.
D. Weiss, K. Geitzenauer, and F. C. Shaw.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 393-400, October 1978. 3 fig, 22 ref.

Descriptors: *Hudson River, *Estuaries, *Marine biology, Diatoms, Benthic flora, Benthic fauna, Sediments, Salinity, Temperature, Water temperature, Dissolved oxygen, Sampling, Surveys, Biology, *Hudson Estuary, Bivalves, Foraminifera.

Foraminifera, diatoms, and bivalves, collected in channel and traverse samples along the lower 184 km of the Hudson Estuary in 1974-1975, showed distinctive distributions along the length of the estuary. Typical assemblages of these potential fossils were designated which correspond approximately to a decrease in salinity northward in the estuary. In general, only freshwater forms were found north of Peekskill, low brackish-water forms penetrated as far south as mid-Manhattan, high brackish-water forms were found as much as 16 km north of this, while normal marine faunas did not penetrate significantly northward of New York Harbor. This paper, in addition to providing baseline data on the present day distribution of these taxa, also defined potential fossil assemblages. These assemblages should prove useful in interpreting past salinity gradients in the Estuary when adequate cores become available. (Sims-ISWS)
W79-04056

ROCKY BOTTOM FAUNA IN A SUBMARINE GULLEY AT LOPPKALVEN, FINNMARK, NORTHERN NORWAY,
Tromsoe Univ. (Norway). Marine Biological Station.
B. Gulliksen.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 361-372, October 1978. 6 fig, 2 tab, 9 ref.

Descriptors: *Benthic flora, *Benthic fauna, *Coasts, *Gullies, Marine biology, On-site investigations, Sampling, Marine algae, Marine plants, Marine animals, Biomass, Tides, Tidal effects, Waves(Water), Topography, Water temperature, Salinity, Light, Photography, Scuba diving, Biology, *Norway.

Vertical and horizontal distribution of macrobenthic flora and fauna were investigated on the vertical, rocky walls of a submarine gulley at Loppkalven (70 deg 18 min N, 21 deg 22 min E) in Northern Norway. The length of the gulley was 55 m at the water surface, and the water depth was 12 m near the opening. Less than 1% of the surface light at the opening was recorded near the bottom (6-8 m depth) in the inner parts. Brown algae and non-calcareous red algae were absent, even in the tidal zone, at the terminal end of the gully. Porifera, anthozoans, hydrozoans, and bryozoans were the most common sessile animals, and they showed clear vertical and horizontal gradients in their distributions. The amphipods Ischyrocerus anguipes, Sympleustes glaber and Stenothoe monoculoides, the bivalve Hiatella arctica, and the polychaete Eulalia viridis, were the most abundant solitary animals. The distribution of these amphipods and M. helicinus seemed to have the same distribution pattern as either non-calcareous algae or tuft-like bryozoans. (Sims-ISWS)
W79-04057

TURBIDITY MAXIMA IN PARTIALLY MIXED ESTUARIES: A TWO-DIMENSIONAL NUMERICAL MODEL,
National Oceanic and Atmospheric Administration, Miami, FL. Atlantic Oceanographic and Meteorological Lab.
J. F. Festa, and D. V. Hansen.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 347-359, October 1978. 9 fig, 18 ref.

Descriptors: *Turbidity, *Estuaries, *Model studies, Mathematical models, Sediments, Suspended solids, Particle size, Circulation, Water circulation, Sediment transport, Settling velocity, Tidal effects, Tidal waters, Rivers, Oceans, *Turbidity maxima.

A steady-state numerical model was developed to help explain the prescence of the turbidity maximum in partially mixed estuaries. The model supports the hypothesis that estuarine dynamics are primarily reponsible for its occurrence. The magnitude and location of the turbidity maximum were shown to depend upon the settling velocity (particle size) of the sediment, the amount of sediment introduced at both the ocean and river source, and the strength of the estuarine circulation. This phenomenon was not simply related to the river input of sediments since results showed the existence of a turbidity maximum for a sediment source which is predominately oceanic. Sediment flux stream functions showed the presence of a closed cell when a turbidity maximum exists. (Sims-ISWS)
W79-04058

MEAN UPWELLING VELOCITIES ON THE OREGON CONTINENTAL SHELF DURING SUMMER 1973,
Woods Hole Oceanographic Institution, MA.
H. L. Bryden.
Estuarine and Coastal Marine Science, Vol. 7, No. 4, p 311-327, October 1978. 4 fig, 4 tab, 24 ref. NSF OCE76-80066, OCE77-2287.

Descriptors: *Upwelling, *Continental shelf, *Oregon, *Model studies, Mathematical models, Heat balance, Velocity, Oceans, Currents(Water), Ocean currents, Ocean circulation, Coasts, Winds, Temperature, Summer, Oceanography, *Upwelling velocities, *Oregon coast waters.

Mean vertical velocities for a 56-day period during Summer 1973 were estimated from consideration of the heat balance and mass conservation at a mid-shelf location in the coastal waters off Oregon. In the heat balance, vertical velocity is required to carry cold water upward predominantly to balance horizontal advection of warm water toward the coast by onshore velocities below 20 m depth. In the conservation of mass, vertical velocity is required to transport water upward to balance the onshore transport below 20 m. The two sets of vertical velocities at four depths agreed within 0.002 cm/s, which is less than their estimated errors. The upward velocities were found to increase from 0.003 cm/s at 87.5 m to 0.016 cm/s at 30 m depth. These vertical velocities are as large as those estimated previously during upwelling events of a few days duration. Because they are time-averages over almost two months, these mean vertical velocities are likely to be more important than

the event-scale vertical velocities in the coastal circulation. Comparisons of observed onshore and offshore transports with the wind-driven offshore transport predicted by simple models suggested that the coastal circulation is a factor of 3 larger than that predicted from observed local winds. (Sims-ISWS)
W79-04059

A STUDY OF LOUISIANA'S MAJOR ESTUARIES AND ADJACENT OFFSHORE WATERS,
Louisiana Wildlife and Fisheries Commission, New Orleans.
B. B. Barrett, J. L. Merrell, T. P. Morrison, M. C. Gillespie, and E. J. Ralph.
Technical Bulletin No. 27, April 1978. 197 p, 1 append.

Descriptors: *Water properties, *Water quality standards, *Water chemistry, *Estuaries, *Louisiana, Salinity, Turbidity, Water temperature, Dissolved oxygen, Water depth, Data collection, Nitrogen, Zooplankton, Nekton, Microorganisms, Area distribution, Biology, Estuarine fisheries, Estuarine environment, Coasts, Invertebrates, Vertebrates.

This report presents data on seven of Louisiana's major estuaries and adjacent offshore waters which were sampled monthly from October 1974 to September 1976. The samples provided information on the water bodies' physical properties, chemistry, amount of nekton, zooplankton, and chlorophyll a. Characteristics of physical properties include water depth, tides, sea states, salinity, temperature, and area rainfall. The data are presented in tables and figures. The water chemistry was analyzed in relation to DO levels, turbidity, nitrate-nitrite values, ammonia levels, total nitrogen and phosphorus amounts, and other related chemical properties. A systematic survey of all zooplankton organisms with the appropriate conditions under which they were collected is presented in various charts and figures. Also, a systematic account of both vertebrate and invertebrate species found in the waters is presented with Latin names, characteristics of the species, and major habitats. When evident, correlations and interrelationships among the various parameters are presented along with tabular information on all measurements made during the study. The variability of the parameters sampled were primarily the result of one or more of the following factors: amount of freshwater introduction, season, and proximity to oceanic waters. An extensive appendix lists area, station, dates, and levels of all parameters collected. (Coan-NC)
W79-04156

SUSPENDED SOLIDS IN WATER.
Plenum Press (New York and London). 1974. 320 p. Gibbs, R. J. (editor).

Descriptors: *Suspended solids, Oceans, Settling velocity, Conferences, Water properties, Turbidity, Physical properties, Storms, Chesapeake Bay, Natural streams, Refractivity, Instrumentation, Calibrations, Sediment transport, Continental shelf, Africa, Foreign countries, South America, Atlantic Ocean, Tropical regions, Benthos, Gulf of Mexico, Surface waters, Chemical reactions, Optical techniques, Light scattering, Caribbean Sea, Atlantic trough.

Principles of studying suspended matter and its settling rate, principles of optical techniques, nearshore and offshore studies are the main categories of 19 technical papers by different authors originally presented at a symposium held March 20-22, 1973, in Santa Barbara, California, sponsored by the U.S. Office of Naval Research. This volume is an edited compilation of the symposium proceedings. (Brown-IPC)
W79-04258

RIVERINE INFLUENCE ON ESTUARIES: A CASE STUDY,
Alabama Univ., Dauphin Island. Marine Science Programs.
W. W. Schroeder.
In: Estuarine Interactons, p 347-364, 1978. 12 fig, 1 tab, 11 ref. Academic Press, New York. OWRT A-058-ALA(1).

Descriptors: *Discharge rate, *Tides, Wind, Salinity variatons, *Estuaries, Mobile Bay.

The Mobile Bay, Alabama estuary is a moderate-size, shallow, semi-enclosed coastal embayment with a simple triangular shape and a small tidal amplitude. It is also the terminus of the fourth largest river system in the United States, in terms of discharge, and the sixth largest on the North American continent. The average discharge of the Mobile River System is approximately 1,750 m3sec-1 and the 10 and 90 percentile discharges are approximately 4,250 and 379 m3sec-1, respectively. Waters from the system have a multi-faceted impact on the Mobile Bay. Discharges in excess of 7,000 m3sec-1 are considered flooding and if they prevail over extended periods (10 to 15 days), can turn most of the bay into a near limnetic environment. Low-flow intervals, discharges less than 500 m3sec-1, allow the upper bay waters to reach salinities >26 ppt. Between these extreme conditions the river waters exhibit a variety of dispersion patterns as a function of specific discharge rate, local wind fields and amplitude of the astronomical tide, which results in significant longitudinal, lateral, and vertical salinity variations. W79-04350

HYDRAULICS IN THE COASTAL ZONE.
Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, New York, 1977. Cost $16.00.

Descriptors: *Tidal waters, *Conferences, *Hydraulics, *Coasts, *Estuaries, Publications, Flow, Tidal effects, Coastal structures, Shore protection, Groundwater, Aquifers, Beaches, Mathematical models, Model studies, Wave pile-up, Inlets(Waterways), Hydraulic structures, Land subsidence, Fish handling facilities, Fish barriers, Dredging, Erosion, Beach erosion, Stratified flow, Hydraulic models, Channel flow, Canals, Jets, Waves(Water), Water pollution, Dispersion, Scour, Analytical techniques, *Tidal hydraulics.

The purpose of the conference was to focus attention on hydraulics in the coastal zone. Subject areas covered the 46 papers included: tidal hydraulics mathematical models, tidal hydraulics, hydraulic structures, groundwater, hydraulic transport, groundwater-surface water, hydromechanics, fish handling structures, land subsidence, dredged material disposal, waterways inlets, and estuaries. (See also W77-08335, W78-05422, W78-06186 and W79-04352 thru W79-04388) (Humphreys-ISWS)
W79-04351

COMPARISON OF NUMERICAL SIMULATION FLOW MODELS FOR COASTAL INLETS,
North Carolina State Univ. at Raleigh. Dept. of Civil Engineering.
J. L. Machemehl, and T. C. Gopalakrishnan.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, Aug 10-12, 1977. American Society of Civil Engineers, New York, p 1-10, 1977. 3 fig, 3 ref. NOAA Grant 04-6-158-44054.

Descriptors: *Inlets(Waterways), *Model studies, *North Carolina, Coasts, Numerical analysis, Analytical techniques, Finite element analysis, Flow, Tidal waters, Mathematical models, Currents(Water), *Masonboro Inlet(NC), Galerkin techniques.

A numerical simulation model for the computation of flow in inlets wit junctions was developed. This model used the Galerkin Technique with a finite element analysis. The vertically integrated equations of momentum and mass conservation were used with the appropriate boundary and initial conditions. The finite element model was used to investigate the flow in Masonboro Inlet, North Carolina. The junction conditions were introduced by the time rates of change of energy and mass flux at the junctions. The effectiveness of the 'double sweep' approach in solving the flow dynamics was described, along with a discussion of appropriate shape functions. The computer results from the finite element scheme were compared with the field data and with the results from the finite difference schemes. The analysis of the inlet required approximately 1 min on the IBM 370 for a tidal cycle. The Galerkin finite element analysis of flow was found to provide good accuracy considering the complex nature of the phenomenon. (See also W79-04351)(Humphreys-ISWS)
W79-04352

A SET OF COORDINATED MATHEMATICAL MODELS FOR THE COASTAL ZONE,
University of South Florida, Tampa. Coll. of Engineering.
B. E. Ross, M. W. Anderson, and P. Jerkins.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 11-18, 1977. 6 fig, 15 ref.

Descriptors: *Mathematical models, *Coasts, *Estuaries, *Florida, Water quality, Inlets(Waterways), Tidal waters, Floods, Model studies, Analytical techniques, Dredging, Water levels.

A brief expose of some aspects of a coordinated set of mathematical models was presented. The state of development of the models is sufficient that consulting engineers, with a reasonable knowledge of modeling, can obtain useful results. The set of models included an estuary or near shore coastal zone hydraulic model which has the capability of simulating various flow boundary conditions such as submerged islands, channels, causeways, etc. Also included in the set as subroutines were an advanced hurricane subroutine, a water quality subroutine, a power plant siting subroutine and a dredging-sediment transport subroutine. The basic model was supplemented by wave refraction-diffraction and wind driven wave programs. A coastal sediment transport model is under development to find use in beach erosion problems of the Tampa Bay Region. Examples of the types of coastal zone problems that have been successfully resolved utilizing these mathematical models were presented. A partial list of these included (1) the location and sizing of bridges in a causeway, (2) complete water quality studies for various areas, (3) the establishment of hurricane flood tide elevations for the Tampa Bay Region, (4) an evaluation of the effects of dredge and fill in Boca Ciega Bay, Florida and (5) the shoaling of Clearwater, Florida. (See also W79-04351) (Humphreys-ISWS)
W79-04353

A THREE-DIMENSIONAL NUMERICAL MODEL OF ESTUARINE CIRCULATION,
Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
R. B. Gordon, and M. L. Spaulding.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 19-27, 1977. 8 fig, 7 ref.

Descriptors: *Estuaries, *Water circulation, *Model studies, Mathematical models, Numerical analysis, Salinity, Currents(Water), Finite element analysis, Tidal waters, Circulation, Water quality, Analytical techniques, Spatial distribution, *Providence River(RI).

This paper described the development of a three-dimensional numerical model of circulation and salt distribution was described. This coordinate transformation has the advantage of mapping the free surface and bottom boundaries onto coordi-

nate surfaces and allows for a uniform vertical grid resolution throughout the modeled region. It also results in some distinct advantages over previous, arbitrarily layered approaches. Explicit finite-differences were used to approximate the system of coupled, non-linear partial differential equations. The computational tests described suggest the suitability of the numerical technique for simulating three-dimensional flows in estuaries with non-uniform density distributions. (Humphreys-ISWS)
W79-04354

INTAKE SCREENWELL SURGING CAUSED BY WAVE DYNAMICS,
Stone and Webster Engineering Corp., Boston, MA.
For primary bibliographic entry see Field 8A.
W79-04357

IMPROVED DRAG FORCE LINEARIZATIONS FOR STRUCTURAL DYNAMIC CALCULATIONS,
McDermott (J. Ray) Co., Inc., New Orleans, LA.
For primary bibliographic entry see Field 8B.
W79-04358

DETERMINATION OF FLOOD LEVELS ON THE PACIFIC NORTHWEST COAST FOR FEDERAL INSURANCE STUDIES,
CH2M/Hill, Redding, CA.
D. E. Dorratcague, J. H. Humphrey, and R. D. Black.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Specialty Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 73-81, 1977. 8 fig, 10 ref.

Descriptors: *Flood stages, *Coasts, *Estuaries, *Oregon, *Washington, *Pacific coast region, Insurance, Tides, Flood frequency, Wave pile-up, Analytical techniques, Tidal waters, Flooding, Surges, Wind tides, Wave(Water), Flood recurrence interval, Flood zones, Storm surge.

The northern Oregon and southern Washington coastal areas that were studied are characterized by shallow sloping and sandy beaches below the high tide line and either sand dunes or rock cobble banks above the high tide line. In many areas, houses and motels have been built on these dunes and banks. A number of these existing and proposed structures are subject to ocean flooding and wave damage. Flood levels on the open coast are determined by a combination of astronomical tide and storm surge, which comprise the stillwater level, and storm wave runup. Not only must the magnitude of these three components be computed, but a frequency of occurrence must be assigned to their combined height. Established methods for computing astronomical tide and wave runup were combined with a storm surge computer model and extreme event statistics to provide an open coast flood computation procedure. A general flow chart of the procedure was given. It was found that this method produced flood levels that agreed well with high watermarks obtained during reconnaissance in the study areas. The storm surge model reproduced surge peaks with suitable accuracy but had some difficulty in reproducing surges in time. (See also W79-04351)(Humphreys-ISWS)
W79-04359

THE DYNAMICS OF THE COASTAL BOUNDARY WATERS OFFSHORE SOUTHERN NEW JERSEY,
Pandullo Quirk Associates, Wayne, NJ.
J. De Alteris, D. Shahrabani, J. Kroll, N. Papageorgis, and K. Konrad.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 82-89, 1977. 4 fig.

Descriptors: *Coasts, *New Jersey, *Tidal effects, *Storms, Oceans, Tidal waters, Currents(Water), Tides, Hurricanes, Analysis, Analytical techniques, Oceanography, Ocean currents, Unsteady flow, Waves(Water), On-site data collections, *Delaware Bay, *Middle Atlantic Bight.

The response of the southern New Jersey coastal waters to three types of meteorological events was described using observations of currents, waves, and tides. During summer doldrums, harmonically predictable tidal currents account for up to 80% of the energy in the current data. The influence of Delaware Bay mouth results in an amplification of the tidal currents in the southern portion of the study area. The transient response of the nearshore waters to a March Northeaster and Hurricane Belle was documented. In both cases, tidal currents were masked totally by an intense barotropic coastal jet generated by the wind stress. The storm-generated, barotropic, coastal jet currents appear to be influenced by the bay mouth, resulting in currents 1 fps greater in magnitude at Wildwood compared to Ocean City. (See also W79-04351) (Humphreys-ISWS)
W79-04360

TIDAL JET FLOWS NEAR INLETS,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
U. A. Unluata, and E. Ozsoy.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, Augut 10-12, 1977. American Society of Civil Engineers, New York, p 90-98, 1977. 8 fig, 11 ref.

Descriptors: *Inlets(Waterways), *Tidal waters, *Hydraulics, *Model studies, Jets, Mathematical models, Hydraulic models, Analytical techniques, Analysis, Flow, Tides, Flow characteristics, Tidal jet flows.

Turbulent jets issuing from tidal inlets during the ebb flows were analyzed, and the effects of bottom friction and one-dimensional depth variations were shown to change the jet behavior in a drastic way. Jets on a constant bottom with friction expand in an explosive manner. When the depth increases in the offshore direction, the expansion rate of the jet is greatly reduced. Measurements obtained in five individual experiments demonstrated fair agreement with the analytical solution. The analytical solutions were verified against field evidence and preliminary experiments. (See also W79-04351)(Humphreys-ISWS)
W79-04361

WAVE RUNUP ON IRREGULAR BEACH PROFILES,
MacLaren (James F.) Ltd., Toronto (Ontario).
A. T. K. Fok, and C. Marche.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 99-106, 1977. 6 fig, 1 tab, 6 ref.

Descriptors: *Beaches, *Waves(Water), *Coasta, *Model studies, Laboratory tests, Wave pileup, Hydraulic models, Analytical techniques, Analysis, Testing procedures, Measurement, Wave runup.

The primary purpose of this study was to determine the safe elevation of a coastal structure against possible flooding caused by wave runup. Physical model tests were conducted. This article described the criteria for selecting model scales, the testing facilities, the construction methods, experimental procedure, and the results. A comparison between theoretical and experimental approaches and a discussion of results obtained from different beach profiles were included. It was found that the theoretical approach underestimates the runup on the irregular beach profils of the study area. (See also W79-04351)(Humphreys-ISWS)
W79-04362

SALINITY DISTRIBUTION OF A HIGHLY STRATIFIED ESTUARY,
Florida Univ., Gainesville. Dept. of Coastal and Oceanographic Engineering.
Y. H. Wang.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 130-135, 1977. 4 fig, 3 ref.

Descriptors: *Estuaries, *Stratified flow, *Salinity, *Model studies, Distribution patterns, Profiles, Density, Mathematical models, Analysis, Analytical techniques.

A highly stratified estuary may be described as two superimposed streams of different densities (fresh- and saltwaters) and velocities. There are two types of problems that are often of interest: (1) to calculate the density distribution across the interfacial region for given flow conditions, and (2) to determine the interfacial stability for given density and velocity distributions. The first problem involves solving the equations of motion and diffusion equations simultaneously. The second problem deals with the solution of the Taylor-Goldstein equation with proper boundary conditions. It is desirable for both problems that an expression of the density profile with variable scales be devised. Natural occurrances and laboratory experiments about stratified free shear flows are often found having different vertical scales of velocity and density. The ratio of the two scales has an effect of the prediction of concentration distribution. The current paper tried to embed these two vertical scales into a density profile of a variable vertical scale. This 'versatile' density distribution was compared with laboratory measurements. (See also W79-04351) (Humphreys-ISWS)
W79-04364

THE FRESH WATER LENS IN A BARRIER BEACH,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
D. W. Urish.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 161-168, 1977. 5 fig, 9 ref.

Descriptors: *Groundwater, *Beaches, *Rhode Island, *Model studies, Freshwater, On-site investigations, Tidal waters, Groundwater movement, Coasts, Tidal effects, Analytical techniques, Freshwater lens.

Oceanic landmasses, under natural conditions, commonly develop a body of fresh groundwater. This freshwater body assumes the form of a lens floating on the underlying seawater and is usually thickest at the central part of the landmass tapering to a thin edge at the shore margins. With certain unique exceptions as described herein, the flow moves from the thickest part of the lens outward and upward to the shoreline. The extent of a freshwater lens depends primarily on landmass width, permeability, rainfall, and tidal range. (See also W79-04351) (Humphreys-ISWS)
W79-04367

EVALUATION OF A BARRIER AGAINST SEAWATER INTRUSION,
Los Angeles County Flood Control District, CA.
J. S. Angus.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Staton, August 10-12, 1977. American Society of Civil Engineers, New York, p 187-194, 1977. 4 fig.

Descriptors: *Groundwater, *Saine water intrusion, *Coasts, *Saline water barriers, Water Pollution sources, Analytical techniques, Analysis, Encroachment, Flow, Saline water.

Wherever the demand for freshwater from coastal aquifers approximates or exceeds the supply, seawater intrusion presents a serious problem. This paper dealt with studies made of functioning barriers to trace locations of suspected deficiencies and to determine if supplemental construction is warranted. A brief description of barriers was presented, followed by the means for detecting intrusion, types of data employed, preparation of data, and procedures for analyzing the data. The procedures are not sophisticated due to the nature of the data, and those described have proven useful in practical applications. It was concluded that: (1) Groundwater elevations, pressure gradients, and chloride concentrations data figure prominently in analyzing barrier effectiveness; (2) Chloride concentrations analyses is simplified when the water samples are obtained by a single method; and (3) Groundwater elevation measurement should be adjusted to reflect specific weight unless the intruded aquifer is near ground surface and the water is fresh or nearly so. (See also W79-04351)(Humphreys-ISWS)
W79-04370

DIFFRACTION OF WAVES BY A SHORE-CONNECTED BREAKWATER,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W79-04377

A GENERALIZED POINT-VELOCITY METHOD FOR DISCHARGE COMPUTATIONS IN TIDAL WATERWAYS,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
A. J. Mehta, E. J. Hayter, and B. A. Christensen.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 261-268, 1977. 2 fig, 1 tab, 3 ref. 1 append.

Descriptors: *Discharge(Water), *Tidal waters, *Inlets(Waterways), *Model studies, Analytical techniques, Analysis, Flow, Hydraulics, Mathematical models, Tidal streams, Computer programs.

An analytic method was described for a rational approach to relate the velocity measured by a current meter, at any given position in a non-stratified tidal waterway cross section, to the total discharge through the same section. A single set of cross-sectional velocity measurements is required for calibrating the equations with respect to the bed roughness k, given the cross-sectional geometry, measured discharged, tidal elevaltion and the slope of the energy grade line. With k known, the discharge Q may be determined for a given current meter speed and tidal elevation at any instant. An example illustrated the method where Q was determined as a function of time over at 45 hour period. The computer program was listed in an appendix. (See also W79-04351). (Humphreys-ISWS)
W79-04378

EXPERIMENTAL STUDIES OF BEACH SCOUR DUE TO WAVE ACTION,
Korean Ocean and Research Development Inst., Seoul (South Korea).
W. O. Song, and R. E. Schiller, Jr.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 328-335, 1977. 5 fig, 7 ref.

Descriptors: *Scour, *Beaches, *Model studies, *Coastal structures, Waves(Water), Erosion, Hydraulic models, Laboratory tests, Sea walls, Analytical techniques, Analysis, Beach erosion.

A series of experiments were conducted to investigate the processes involved in the formation of beach scour, caused by wave action on natural beaches and seawall beaches. Reflection coefficients were determined for the natural beach and for various seawall beaches by the envelope method and the Coastal Engineering Research Center (CERC) method. Results of the two methods agreed closely. The wave surface profiles and the corresponding horizontal and vertical velocity components of the water particles at designated points on the free water surface were calculated on the basis of linear standing wave theory and with second water order wave theory. Comparison of the two wave theories indicated that the linear standing wave theory gives good results as a first approximation. An equation to predict the scour depth at the toe of a seawall was developed by the use of regression analysis. (See also W79-04351)(Humphreys-ISWS)
W79-04386

EFFECTS OF AMBIENT CURRENT AND DENSITY STRATIFICATION ON BUOYANT JETS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resource.
For primary bibliographic entry see Field 5B.
W79-04387

TRANSPORTATION OF ORGANIC DETRITUS IN ESTUARIES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. S. Fisher, and J. C. Pickral.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 344-351, 1977. 2 fig, 2 tab, 5 ref.

Descriptors: *Estuaries, *Detritus, *Model studies, *Laboratory tests, Salt marshes, Tidal waters, Water quality, Hydraulic models, Movement, Organic matter, Sediment transport, Particle size, Settling velocity, Analysis, Organic detritus.

The entrainment of benthic particulate organic detritus is predictable from a Shields diagram. The samples were collected from a small tidal satl marsh. A measurement of size and fall velocity appears to be sufficient to estimate the shear velocity at the initiation of motion. This paper presented the results of a series of laboratory flume studies intended to establish the threshold of motion for several different detrital samples as a function of the bottom shear stress. It was shown that is will be possible to predict when various types and sizes of particulate organic detritus begin to move on the bottom of a marsh. This information will be fundamental to a general analysis of the role of this material in the determination of water quality of these water bodies. (See also W79-04351) (Humphreys-ISWS)
W79-04388

APPROPRIATION FOR INSTREAM FLOW MAINTENANCE: A PROGRESS REPORT ON 'NEW' PUBLIC WESTERN WATER RIGHTS,
Indiana Univ., Bloomington.
For primary bibliographic entry see Field 6E.
W79-04438

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DETERMINATION OF THE TECHNICAL POTENTIAL OF THE LIME-MAGNESIUM CARBONATE PROCESS, VOLUME I,
Radian Corp., Austin, TX.
D. M. Ottmers, Jr., and T. J. Hubbard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 182, Price codes: A05 in paper copy, A01 in microfiche. OWRT/S--76/20, Vol. II, June 1972. 75 p. DOI 14-30-2952.

Descriptors: *Water treatment, *Carbon dioxide, *Calcium, *Mass transfer, Design, Chemical precipitation, Sea water, Flow rates, Engineering feasibility, *Magnesium carbonate, Model studies, *Pre-treatment(Water), Desalination, *Computer programs, Magnesium hydroxide, Alkaline scale, *Lime-magnesium carbonate processes, *Feed water treatment, *Calcium ions.

An engineering analysis has been made for the lime-magnesium carbonate (LMC) process. The response of the LMC process to variations in several operating conditions was determined. For calcium and carbon dioxide (carbonate ion) removal there is an optimum for the amount of CO2 sorbed in the carbonator. There is also an optimum amount of secondary raw sea water for the magnesium hydroxide precipitation. Use of evaporator blowdown for secondary water is not feasible unless calcium sulfate precipitation in the magnesium hydroxide precipitator can be eliminated by optimizing process flow rates or compensated for in downstream vessels. The lime split between the calcium carbonate precipitation train and magnesium hydroxide precipitator has an optimum value. Vapor-liquid-solid mass transfer rates and various equipment designs should be examined to determine the potential of this process modification. A computational technique was devised that allows for a realistic investigation of process alternatives and processing condition changes such as flow rates and solids loadings.
W79-04161

YOU NEVER MISS THE WATER ... TILL THE WELL RUNS DRY,
For primary bibliographic entry see Field 6D.
W79-04244

POWER GENERATION AND POTABLE WATER RECOVERY FROM SALINOUS WATER,
Universal Oil Products Co., Des Plaines, IL. (Assignee).
D. B. Carson.
U.S. Patent No. 4,121,977, 12 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1508, October 24, 1978.

Descriptors: *Patents, *Desalination processes, *Water purification, Potable water, Solar radiation, Separation techniques, Electric power production, Thermal powerplants, Condensation, Solar heat sink, Ocean thermal gradient.

A process for simultaneously generating power and recovering potable water from sea water is described. Salinous water, from close to the surface and at a relatively high temperature, is increased in temperature via indirect contact with a vaporous phase, derived from the surface water at an elevated temperature and a subatmospheric pressure. The preheated salinous water is exposed to radiant solar energy, in a solar radiation heat sink, to further increase the temperature. Thus-heated water is introduced into a first flash separation zone, maintained at subatmospheric pressure, to provide a first substantially non-salinous vaporous phase and a first salinous liquid phase. The first vaporous phase is passed into and through a turbine, from which power is generated. The first liquid phase is introduced into a second flash separation zone, maintained at a lower absolute pressure to provide a second salinous liquid phase and a second substantially non-salinous vaporous phase. The latter is utilized to preheat the surface water. The second liquid phase is introduced into a third flash separation zone, maintained at a lower absolute pressure than the second flash zone, to provide a third salinous liquid phase and a third substantially non-salinous vaporous phase. Vapors exiting from the turbine and the third vaporous phase are cooled and/or condensed via indirect contact from sea water obtained from a depth substantially lower than the surface and at a comparatively lower temperature to recover liquid potable water. (Sinha-OEIS)
W79-04468

SEA WATER DESALINIZATION SYSTEM,
L. A. Vlasnik.
U.S. Patent No. 4,122,012, 5 p, 1 fig, 1 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1517, October 24, 1978.

Descriptors: *Patents, *Desalination, *Desalination apparatus, Sea water, Filtration, Ion-exchange, Barriers, Sands, Basins, Separation techniques, Flow separation, Guayule plant(Parthemium argentatum).

A system for the desalinization of sea water is provided, which includes a barrier buried to a depth below the low tide water level in a sandy beach, and a collector vault, or well, buried in the beach behind the barrier. The vault has an opening in its side for receiving water passing through the barrier. The barrier is filled with selected filter materials, and the sand in the area between the barrier and the vault is treated with a selected material. After a period of pumping, desalinated water will appear in the vault and may be pumped out of the vault. Whenever the water in the vault is pumped below a particular level, a new supply of desalinated water will flow in through the opening in its side from the barrier. It is believed that the filter materials contained in the barrier set up an ion-exchange reaction in the saline or brackish solution passing through the barrier, and this ion-exchange reactions causes a desalinated water separation, with the lighter desalinated water flowing above the heavier brine or brackish solution through the sand and into the opening in the vault. The heavier brine solution is dispersed in the sand or may be pumped to waste through an appropriate drainage system. The sap of the guayule plant (Parthenium argentatum) is placed in the sand between the barrier and the vault, and this sap reacts with residual compounds in the sea or brackish water after passing through the barrier to cause such heavier materials to gravitate down into the brine solution underlying the upper layer of desalinated water. (Sinha-OEIS)
W79-04472

TURBULENT TRANSPORT TO A ROTATING CYLINDER,
California Univ., Berkeley. Dept. of Mechanical Engineering.
J. T. Teng, and R. Greif.
Letters in Heat and Mass Transfer, Vol. 3, p 365-374, 1976. Pergamon Press. (California Water Resources Center Desalination Project) S-176.

Descriptors: *Turbulent flow, *Heat transfer, *Mass transfer, *Momentum transfer, Velocity, Temperature.

The turbulent flow about a rotating cylinder, in an otherwise quiescent fluid, is studied. Velocity and temperature distributions are obtained by solving the corresponding conservation equations. A modified mixing length, which includes the effect of centrifugal forces in terms of the Richardson number, is used. A comparison is made with experimental data over a range of Reynolds numbers from 16,000 to 72,000. (Snyder-Calif Davis)
W79-04486

3B. Water Yield Improvement

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04143

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N.
Big Muddy River Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04144

PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, AN OVERVIEW OF THE SKYWATER IX CONFERENCE.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2B.
W79-04157

BLASTING-IT TURNS DRY HOLES INTO WET ONES,
Universal Oil Products, St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8A.
W79-04251

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

3C. Use Of Water Of Impaired Quality

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
E. C. Dickey, and W. D. Lembke.
Bulletin 758, Agricultural Experiment Station, University of Illinois at Urbana-Champaign, July 1978. 37 p, 13 fig, 4 tab, 47 ref, 1 append.

Descriptors: *Water wells, *Ponds, *Water supply, *Water quality, *Illinois, On-site data collections, Laboratory tests, Chemical analysis, Nitrates, Ammonia, Chlorides, Biochemical oxygen demand, Potassium, Phosphorus, Nitrogen, Dissolved oxygen, Groundwater, Wells, Farm ponds, Stock water, Potable water, *Washington County(IL), *Pope County(IL).

In a broad geographic band immediately south of the central Corn Belt, water supplies for domestic use and livestock are beset with problems. The flow of groundwater into shallow dug wells tends to be unreliable during dry seasons, and the flow rate through compact soils is at best only moderate to low at all times. In addition, the nitrate-nitrogen content in nearly 3/4 of the shallow wells in a representative county exceeded the U.S. Public Health Service standard, in some cases by tenfold. In contrast, 72 farm ponds sampled for nitrate-nitrogen were well below the standard of 10 milligrams per liter. Preliminary findings in Washington County, Illinois, in 1970 led to the research reported here, which is part of a larger study of nitrogen in the environment. The first section of this bulletin advanced a theory to explain excessive nitrate concentrations in some farmstead wells. The second section focused on nitrogen regimes in 15 farm ponds and one lake. It was assumed at the outset that little can be done in the short run to reduce the amount of nitrates in farm wells. For this reason ponds were studied as possible alternative sources for drinking water. An economic analysis showed that well-water systems in use in Washington County are the least costly available, but that water quality and quantity are for the most part undependable. Alternatives include farm ponds, municipal water supplies, transported water, and various combinations of these sources. Farm ponds with a purification system could be one of the more satisfactory alternative sources provided that water storage facilities are available for prolonged droughts. (Sims-ISWS)
W79-04068

SOIL-WARMING FOR WASTE HEAT DISPOSAL, CROP GROWTH ENHANCEMENT AND WASTE WATER RENOVATION,
The Pennsylvania State Univ., University Park, PA. School of Forest Resources.
D. R. DeWalle, D. D. Fritton, L. T. Kardos, D. P. Knievel, and J. M. Norman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 902, Price codes: A12 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources, Pennsylvania State University, Final Technical Report, December 1978. 267 p, 59 fig, 53 tab, 122 ref. OWRT C-6249(No. 5222)(4). 14-31-0001-5222.

Descriptors: *Evapotranspiration, *Soil temperature, *Sewage effluents, *Irrigation, Crop production, Alfalfa, Orchardgrass, Sudangrass, Water reuse, *Municipal wastewater.

To examine feasibility of utilization and dissipation of reject heat from power production, year-round soil-warming effects on subsurface and surface heat exchange, crop growth/development and renovation of municipal waste water were determined in central Pennsylvania. The soil in a 0.09 ha test plot was artificially heated by circulating water heated to 38C through a buried, parallel pipe network. Both the heated plot and an adjacent unheated control area were irrigated weekly with 1.5 cm municipal sewage effluent. Measurements of soil heat flow, pipe heat loss, soil temperatures, pipe temperatures, and soil thermal conductivity tested theoretical steady-state models describing heat loss from a buried pipe network. The fraction of pipe heat loss dissipated by evapotranspiration was determined through weighing microlysimeters. A horizontal atmospheric advection model scaled the small plot heat loss data to a full-sized area. Crop research focused on warm soil effects on winter survival, maturation, development, yield, quality and pest relationships for alfalfa, orchardgrass, tall fescue, winter wheat, winter barley, snapbeans and sudangrass. Crop research included a greenhouse study of soil temperature and compaction effects on root growth of tall fescue. The influence of the warm soil on the chemical composition of the applied sewage effluent was determined from samples periodically collected with suction lysimeters and analyzed for pH, NO3-N, organic-N, Cl-, total soluble salts and soluble orthophosphate.
W79-04080

ECONOMIC ANALYSIS OF THE CONJUNCTIVE USE OF SURFACE WATER AND GROUND WATER OF DIFFERING PRICES AND QUALITIES: A COMING PROBLEM FOR ARIZONA AGRICULTURE,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 6B.
W79-04104

GROUND-HEAT-ASSISTED HEAT PUMPS,
For primary bibliographic entry see Field 8C.
W79-04243

GEOTHERMAL GOES EAST,
P. Britton.
Popular Science, Vol. 214, No. 2, p 66-69, February 1979. 5 fig.

Descriptors: *Geothermal studies, *Eastern United States, *Geopressured brines, Methane, Natural gas, Atlantic coastal plain, Gulf coastal plain.

Recently, geologists have discovered potentially vast sources of low-temperature geothermal energy along the East Coast. The geothermal heat will be too cool for electrical generation but could be used for space heating, food processing, agriculture, and industry. The hot, pressurized saline water along the Gulf Coast is another potential geothermal resource. Methane can be extracted from it and electricity could be generated with the use of a turbine and heat exchanger. The brine would be reinjected into the earth. Engineering, environmental and institutional barriers to the development of geopressured resources are discussed. (Purdin-NWWA)
W79-04248

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

3D. Conservation In Domestic and Municipal Use

A CROSS-SECTIONAL INVESTIGATION OF THE DETERMINANTS OF URBAN RESIDENTIAL WATER DEMAND IN THE UNITED STATES, 1960 AND 1970,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 6D.
W79-04003

SOCIAL ASPECTS OF URBAN WATER CONSERVATION: A REVIEW OF THE 1971-72 FIELD STUDY,
Century Research Corp., Arlington, VA.
H. E. Abbott, Jr.
In: Proceedings, North Carolina Conference on Water Conservation, September 3-4, 1975. p 6-18, 2 fig. (1975) Water Resources Research Institute, North Carolina State University, Raleigh, J. M. Stewart, Editor. OWRT-C-2134 (No. 3401) (2). 14-31-0001-3401.

Descriptors: *Water shortage, *Water conservation, *Social aspects, Attitudes, Costs, Water utilization, Water supply, Water users, Surveys, Investigations, Regulation, Urban sociology, Domestic water, Reasonable use.

A literature review, conferences with government officials, correspondence with municipal officials, and interviews with producers and consumers of domestic water were used to determine socially acceptable strategies which would effectively conserve domestic water during emergency shortages, and to learn about consumer knowledge of water topics and attitudes towards conservation and regulation. A total of 18 communities was investigated. It was generally concluded that most users are ignorant of their water supply and tend to take it for granted. Most are willing to save water, but don't know how. In order to assure an adequate supply, people are willing to pay more than they do now for water. Radio, newspaper and television are the most effective means of informing people of the need to save water. Although voluntary conservation is usually effective, officials should be prepared to institute legal restrictions. (Davison-IPA)
W79-04094

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

3E. Conservation In Industry

PERSPECTIVES ON DESERTIFICATION,
New South Wales Univ., Kensington (Australia).
For primary bibliographic entry see Field 3F.
W79-04282

WASHING OF UNBLEACHED KRAFT PULP WITH EFFLUENTS (PROMYVKA SUL'FATNOI NEBELENOI TSELLYULOZY STOCHNYMI VODAMI),
Sibirskii. Nauchno-Issledovatel'skii Inst. Tsellyulozy i Kartona (USSR).
G. E. Danilov, N. V. Ogorodnikova, and A. V. Boiko.
Bumazhnaya Promyshlennost', No. 7, p 16-17, July, 1978. 1 fig, 3 tab.

Descriptors: *Pulp wastes, *Water reuse, *Water conservation, Recycling, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Water pollution control, Foreign countries, Laboratory tests, Kraft pulp, Soviet Union(USSR), Black liquor, Condensates, Kraft mills, Board mills, Wash water, Industrial water.

In laboratory experiments at the Siberian Pulp and Board Research Institute, kraft pulp was washed by a process modeling the 8-stage washing process at the Selenga (USSR) mill, namely, with the mill's biologically and chemically purified pulping effluent and with black liquid evaporator condensate. Control experiments were carried out with fresh water. The washing effectiveness was the same as for fresh water washing. The strength of the pulp and of board made from the pulp was lowered slightly, but still within standard requirements. (Stapinski-IPC)
W79-04423

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

3F. Conservation In Agriculture

OBTAINING SPECIFICATIONS FOR MINIMUM COST IRRIGATION SYSTEMS,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6A.
W79-04012

SOIL-WARMING FOR WASTE HEAT DISPOSAL, CROP GROWTH ENHANCEMENT AND WASTE WATER RENOVATION,
The Pennsylvania State Univ., University Park, PA. School of Forest Resources.
For primary bibliographic entry see Field 3C.
W79-04080

A RATIONAL APPROACH FOR OPTIMIZING APPLICATION RATES OF FERTILIZER NITROGEN TO REDUCE POTENTIAL NITRATE POLLUTION OF NATURAL WATERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 5B.
W79-04162

AGRICULTURE AND CONSERVATION--ECOLOGICAL AND SOCIAL ASPECTS,
U. Hampicke.
Agriculture and Environment, Vol. 4, No. 1, p 25-42, April, 1978. 70 ref.

Descriptors: Agriculture, Ecology, Social aspects, Political aspects, Pesticides, Planning, Economic impact, *Water conservation, Europe.

The technological features and the economic and political repercussions were discussed of an agricultural system which would meet strict conservation requirements in central Europe, should they exist. The rate and number of species losses, classification of endangered species and destruction of environmental variety were discussed. It was suggeted that the countryside be divided systematically into areas of high productivity, and others where traditional methods of land use are continued. Three possibilities for protecting ecologically valuable regions were discussed: abolishing the use of pesticides, etc. altogether; improved methods of crop spraying to prevent spray falling onto adjacent areas; and adaptation to unavoidable spray scattering by spatial structuring, i.e., installing bufffer areas between productive and protected zones. With regard to the political and economic consequences of such a system, three indispensable prerequisites were indentified: an adequate system of value judgments in society; sufficient economic flexibility to allow changes; and proper means of coordination, i.e., economic planning. It was concluded that gradual improvements on a local scale are possible and should be encouraged. (Skogerboe-Colorado State)
W79-04164

TENSIOMETERS TEACH HOW TO SAVE FUEL AND WATER,
N. Rodgers.
Irrigation Age, Vol. 12, No. 4, p 45-46, January, 1978.

Descriptors: *Tensiometers, Equipment, Data collections, Irrigation, *Irrigation efficiency, Soil moisture, Moisture tension, Moisture content, Water conservation.

Tensiometers are valuable tools for the irrigator helping him to save money and water during the irrigation season. The irrigation schedule, based on soil moisture tension, can be varied during different periods of the growing season, depending upon the water requirements of the plant. However, they can mislead the irrigator if the tensiometers are not properly placed and maintained. Reading tensiometers daily has been suggested since it will indicate the danger of the tensiometers breaking suction and thus taking false readings can be avoided. (Skogerboe-Colorado State)
W79-04165

NEW MEXICO PUMP STUDY POINTS TO FARMERS' NEED FOR EFFICIENCY KNOWLEDGE.
Irrigation Age, Vol. 12, No. 4, p 34-35, 58, January, 1978. 3 tab.

Descriptors: *Pump testing, *Pumps, *Irrigation efficiency, Natural gas, Irrigation Operation and Maintenance, New Mexico.

A New Mexico irrigation pump study suggestes farmers should know more about pump efficiency and should have expert help in selecting pumps. Overall efficiency of a pumping plant, according to the report, should range from 15 to 20%. A study conducted by Texas Techn College which covered power requirements and efficiencies of 46 natural gas pumps revealed that only six pumps exceeded 15% overall efficiency while 16 had overall efficiencies below 10% and the average was 10.7%. The study conducted in New Mexico suggeted that the average pump efficiency could be improved to 15% and thereby about 1.4 million cubic feet of natural gas used for irrigation pumping during an average year in New Mexico could be saved. This report also provides some guidelines for studying pumping plant efficiency. (Skogerboe-Colorado State)
W79-04166

STUBBLE BURN SCORES.
Irrigation Age, Vol. 12, No. 4, p 16, January, 1978.

Descriptors: *Burning, Infiltration rates, Crop production, Stubble, Costs, Irrigation efficiency.

A study conducted at Texas A and M Unversity compared plots where the straw was worked, where it was removed by bailing where the straw and stubble was burnt off. The results showed that the difference in yields from he three types of plots was statistically insignificant. But the calculated annual savings from burning off each year rather than bailing or working back into the soil was $4.02/acre; whereas burning every other year and every third year could save $2.01 and $1.34/acre respectively. Another study involving infiltration rates showed that the infiltration rate for the burnt area was slower in the first hour, but increased later during a 22-hour period. Total infiltration for the period for the plot with straw worked in was 2.58 inches compared with 2.50 for straw removed and 2.28 inches for the burned area. The effect of straw disposal treatments on soil struction including changes in soil aggregates, bulk density, organic matter and compaction was stuied. Results of dry and wet sieve analyses showed no significant differences among the three treatments. (Skogerboe-Colrado State)
W79-04167

'NO ROOM FOR ERROR' SAY YOUNG IRRIGATOR.
Irrigation Age, Vol. 12, No. 5, p 77, February, 1978.

Descriptors: *Crop production, Idaho, Potatoes, Fertilizers, Herbicides, Pesticides.

The total management approach towards agricultural crop production of a Idaho farmer was discussed. The approach includes frequent soil and plant testing, selection of good seed varieties, timely applications of fertilizers, herbicides, and pesticides of the right king and amount including a good crop rotation program. (Skogerboe-Colorado State)
W79-04168

NEW FLUME BREAKTHROUGH FOR DITCH IRRIGATORS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
A. J. Clemmens, and J. A. Replogle.
Irrigation Age, Vol. 12, No. 7, p 82-88, April, 1978. 3 fig, 3 tab.

Descriptors: *Flumes, *Irrigation ditches, Open channel flow, Flow measurement, Costs, Arizona.

New design methods for critical-flow flumes installed in open channels make on-farm flow measurement simple, accurate, and inexpensive. This paper describes the methods and construction procedures used in developing a new flume to measure water flow in open channels. The cost analysis of the eight flumes tested shows that the cost of the flume is very inexpensive compared with other types of flumes. It also claims to be precise within plus or minus 2%. (Skogerboe-Colorado State)
W79-04169

TAILWATER PITS GAIN POPULARITY IN TEXAS,
J. Blair.
Irrigation Age, Vol. 12, No. 7, p 70-71, April, 1978. 4 fig.

Descriptors: *Tailwater, Silts, Water conservation, *Irrigation practices, Crop production, Equipment.

Tailwater pits are one of the best methods yet divised to save irrigation water on the hardlands of northwest Texas and eastern New Mexico. Interest in them is still high, though the construction rate has slowed because of rising costs and the increase in sprinkle systems. In the recent years tailwater pits are designed according to the size of the field and amount of expected runoff with efficient silt traps. The reprot also suggests to check pump and motor occasionally to increase their refficiencies. It also suggests to irrigate alternate rows, learn when the crops go through stress periods, use limited tillage to reduce evaporation, improve tillage to reduce fuel costs, grow crops that use less water, and go back to terracing the fields if necessary. (Skogerboe-Colorado State)
W79-04170

BASIC IRRIGATION SCHEDULING PROCEDURES,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
P. E. Fischbach.
Irrigation Age, Vol. 12, No. 7, p 66-67, April, 1978. 2 fig.

Descriptors: *Irrigation efficiency, Irrigation water, *Scheduling, Soil moisture, Moisture content, Growth stages, Sweet corn, Moisture meters, Evapotranspiration, Water conservation.

On a fine textures deep soil, four basic irrigation scheduling procedures were compared on corn. The procedures consisted of irrigations according to (1) the calculated crop water use, (2) the average electrical resistance block reaching, (3) the soil moisture content (feel method) at three stages of growth of the corn plant, and (4) a predetermined range of net water application every 14 days. The difference between grain corn yields were not significant at the 5 percent level between scheduling procedures. The least effort to schedule irrigations was with the electrical resistance blocks. Appling only 2 inches of net irrigation water or less each irrigation is important so that nitrogen, water or energy is not wasted. Using a water measuring meter to know how much water was applied appears to be the most critical measurement to save nitrogen, water and energy. (Skogerboe-Colorado State)
W79-04171

EFFECT OF SALINITY ON AGRICULTURE IN IRAQ,
Mosul Univ. (Iraq). Coll. of Engineering.
M. A. Al-Layla.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 195-207, June, 1978. 2 fig, 3 tab, 3 ref, 1 append.

Descriptors: *Salinity, Agriculture, *Irrigation effects, *Return flow, Drainage water, Iraq.

Irrigation has progressed considerably in Iraq, but it has resulted in soil salinity thereby reducing the productivity of the agricultural lands. Land has been reclaimed by taking up drainage projects, but the discharge of the drainage water into the river has considerably increased the salinity of the river water causing deteriation in its quality. The increase in salinity of river water creates problems for irrigation and municipal uses, and therefore, the discharge of drainage water to the river must be controlled. To obtain maximum benefit from the use of land water resources, the problems of irrigation, drainage, control of river water quality, and education of farmers must be tackled as a whole and not in parts. (Skogerboe-Colorado State)
W79-04173

EFFECT OF IRRIGATION REGIME ON MAIZE YIELDS,
Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.
J. W. H. Barrett, and G. V. Skogerboe.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 179-194, June, 1978. 9 fig, 2 tab, 20 ref, 1 append.

Descriptors: Yield equations, Sweet corn, *Crop response, Moisture stress, Growth stages, Evapotranspiration, Crop production, *Irrigation efficiency, Water conservation.

To determine the economically optimal allocation of irrigation water to a given crop, the relationship between the yield of the crop and its use of the supplied water must be known. Different shapes of the function relating yield to water use have been obtained by various researches. The strongly linear relationship between wheat grain yield and precipitation, has been supported by container and field experiments that have demonstrated from any crops a linear relationship between yield and water use until maximum yield is obtained. The purpose of this paper is to present field evidence substantiating the form of the crop yield-water use function and to demonstrate the effects of different irrigtion regimes on the yield of corn. (Skogerboe-Colorado State)
W79-04174

IRRIGATION MANAGEMENT SERVICE AND MOSQUITO CONTROL,
Colorado State Univ., Fort Collins. Center for Disease Control.
R. O. Hayes, and R. L. Nielsen.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 153-163, June, 1978. 1 fig, 2 tab, 19 ref, 1 append.

Descriptors: *Irrigation programs, *Mosquitoes, Irrigation practices, Vectors(Biological), Diseases, Crop production, Irrigated land.

The importance of irrigation to the production of agricultural crops has led to its widespread use throughout the United States. Mosquito production and vector-borne diseases often have been problems in intensely irrigated areas, but in some areas good irrigation water management practices have been shown to mimimize such problems. The evaluation of the Mesa County, Colorado, Irrigation Management Service (IMS) program found it associated with lower site and habitat infestation rates only among the IMS orchard sites, whereas the IMS program was not associated with reduced mosquito production among either alfalfa or corn fields, and no mosquito production was found associated with sugar beet crops, either in or out of the IMS program. Although pastures were not included in the IMS program, they were included in this evaluation, and a high percentage of the pastures examined were associated with mosquito production. The results also revealed that the mosquito fauna, the principal types of mosquito larval habitats, and the water sources for mosquito breeding in the irrigated areas of Mesa County were nearly the same in 1975 as in 1959. (Skogerboe-Colorado State)
W79-04175

NONUNIFORM SPRINKLER IRRIGATION APPLICATION EFFICIENCY,
Sao Paulo Univ. (Brazil). Dept. of Hydraulics and Sanitary Engineering.
F. H. Chaudhry.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR2, p 165-178, June 1978. 4 fig, 15 ref, 43 eqs, 3 append.

Descriptors: *Irrigation efficiency, *Sprinkler irrigation, Uniformity coefficient, Distribution, Statistical methods.

Application efficiency offers a physically significant characterization of nonuniform irrigation which can help in striking a balance between the cost of maintaining higher uniformity and the cost of water. This paper quantifies the role of asymmetry in the various efficiency parameters of nonuniform irrigation representing its areal pattern by a skew distribution. It is shown that if the application ratio or the coefficient of variation, or both, are small, the application efficiency approaches the value of the application ratio. The equality between the application ratio and the application efficiency can be obtained at relatively larger coefficients of variation (or smaller uniformity coefficients) for positively skewed distributions. Given the statistical properties of the sprinkler or surface irrigation distribution and the proposed application ratio, the results of this study should permit a more accurate evaluation of the application efficiency and thus of the economics of the proposed installations. (Skogerboe-Colorado State)
W79-04176

ON-FARM LEVEL-BASIN IRRIGATION--SAVE WATER AND ENERGY,
Agricultural Research Service, Phoenix, AZ.
A. R. Dedrick, J. A. Replogle, and L. J. Erie.
Civil Engineering, Vol. 48, No. 1, p 60-65, January, 1978. 8 fig.

Descriptors: *Surface irrigation, Basins, *Irrigation efficiency, Irrigation systems, Irrigation practices, Water conservation, Automation.

Spiraling energy costs, and the doubtful availability of electricity or natural gas for pumping, stand as a serious threat to future high-energy-consuming water application techniques. Even with the growing concern for water conservation, we may run out of energy before we run out of water. Surface irrigation, because of its lower energy requirements, deserve renewed attention. Thus, despite the merits of its lower energy requirements, deserve renewed attention. Thus, despite the merits of sprinkler and trickle irrigation, conversion from surface irrigation should be approached cautiously, especially where properly designed surface irrigation techniques are suitable. Uniformity of application and resultant minimal water loss over the irrigated area are prime criteria of an irrigation system. These can be attained with level basins by balancing the basin size to the irrigation water supply and soil intake characteristics. The key factors in boosting irrigation efficiencies are suggested as : (1) using lasers to make the farm field as level as possible, (2) using special flumes and weirs to measure water flow, and (3) using automated

gates to control the amount of water applied to a field. (Skogerboe-Colorado State)
W79-04177

DISTRIBUTION PATTERNS AND LOSSES FOR FURROW IRRIGATION,
Colorado State Univ., Fort Collins. Dept. of Agriculture and Chemical Engineering.
D. Karmeli.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IRI, p 59-68, March, 1978. 4 fig, 1 fig, 10 ref, 22 equ, 1 append.

Descriptors: *Furrow irrigation, Surface irrigation, Distribution patterns, *Irrigation efficiency, Model studies, Mathematical models, Recession curves, Infiltration.

A model was developed to describe the distribution patterns and efficiencies for furrow irrigation. The model consisted of the following: (1) A frequency curve of the dimensionless infiltration depth (actual infiltered depth/desired infiltration depth), versus fractional length of run (distance from end of field/total length of field); (2) Description of the frequency curve by a mathematical model that enables the comparison of systems by using the model to establish the various efficiencies and other statistical parameters such as the deviation from desired application depth. The model, based on the power curve fit for surface irrigation systems, was found to be a good representation of actual patterns of distribution in an irrigated field. The model suggested allows for integration of the various functions related to irrigation performance such as water-yield function. (Skogerboe-Colorado State)
W79-04181

DESCRIBING IRRIGATION EFFICIENCY AND UNIFORMITY,
American Society of Civil Engineers, New York.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR1, p. 35-41, March, 1978. 3 fig, 11 ref, 6 equ, 1 append. On-Farm Irrigation Committee of the Irrigation and Drainage Div.

Descriptors: *Irrigation efficiency, Uniformity coefficient, *Standards, Irrigation, Soil moisture, Efficiencies.

There is an urgent need for standardization of efficiency terms used in on-farm irrigation. The purpose of this paper is to provide meanings for several such terms to reduce the vagueness and resulting confusion that now exists. The committee hopes these definitions will be accepted as standards, thus reducing conflicting usage and the consequent need for redefinition each time such terms are used. Only terms applicable to on-farm irrigation practices are presented, although many may be usable for larger units such as irrigation districts or basin wide projects. (Skogerboe-Colorado State)
W79-04183

FLOAT VALVES IMPROVE PIPELINE SYSTEMS,
Science and Education Administration, Kimberly, ID. Agricultural Engineering Div.
A. Humphreys.
Irrigation Age, Vol. 12, No. 7, p 12-15, April, 1978. 1 fig, 1 tab.

Descriptors: Water conservation, *Valves, Flow control, Water shortage, *Irrigation efficiency, Costs.

Water shortages and rising energy and labor costs are forcing irrigators to look for ways to increase irrigation efficiency and reduce operating costs. To accomplish this, they need maximum system flexibility and ease of operation. Many low pressure pipeline systems can be improved by using float valves to provide better and easier water control. Float valves are relatively new and since most of them are used in California where they were developed, many farmers are not familiar with them. This paper discusses the applicability of float valves in various situations of field irrigation systems. (Skogerboe-Colorado State)
W79-04184

HOW IDAHO IRRIGATORS TRIM BACK POWER COSTS,
C. Henry.
Irrigation Age, Vol. 12, No. 8, p 82-84, May-June, 1978.

Descriptors: Scheduling, *Irrigation practices, Electric power costs, Fertilizers, Water conservation, Crop production, Idaho, *Costs.

This article reports the benefits obtained by a Idaho farmer by irrigation scheduling. Irrigation scheduling has not only helped to keep the power cost down but also it has reduced labor-hour requirement, leaching of fertilizers and has resulted in increased yields. One other additional advantage was in management operations, such as thinning and cultivations, during periods indicated by favorable moisture content. (Skogerboe-Colorado State)
W79-04186

LIMITED IRRIGATION TESTS GET RESULTS,
R. Larsen.
Irrigation Age, Vol. 12, No. 8, p 72-74, May-June, 1978. 2 fig.

Descriptors: Water conservation, Moisture deficit, Growth stages, Timing, *Irrigation practices, Corn(Field), Sorghum, Soybeans, Kansas, Nebraska.

Limited irrigation experiments were conducted in Kansas and Nebraska on corn, sorghum and soybean. It was observed by the researchers in the two states that corn yield was reduced by limiting irrigation at any stage of growth but a single irrigation was most effective just before the silking stage. With soybean, they observed that the most critical period was at the beginning of pod development, whereas with sorghum, the timing of irrigation was not found to be important which gives it a management advantage when using limited water. The experiments showed that the limited irrigation techniques help in saving water, energy and irrigation equipment wear and tear. (Skogerboe-Colorado State)
W79-04187

IRRIGATE--A SCHEDULING MODEL,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
P. Tscheschke, J. R. Gilley, T. Thompson, and P. Fischbach.
Agricultural Engineering, Vol. 59, No. 1, p. 45-46, January, 1978. 1 fig, 4 ref.

Descriptors: Water conservation, Scheduling, Irrigation, *Computer models, Computer programs, Timing, Evapotranspiration, Climatic data, *Irrigation systems.

Irrigation is a major consumer of the three scarce commodities: energy, water, fertilizer. The need for conservation through good irrigation management practices is urgent. To help meet these needs, University of Nebraska has developed an irrigation scheduling program called IRRIGATE for its AGNET (Agricultural Computer Network)system. The network serves the Institute of Agriculture and Natural Resources at the University of Nebraska-Lincoln and benefits the agricultural community directly. As with all AGNET models, IRRIGATE is designed for teaching, research and extension work. Access to AGNET can be made through small portable computer terminals. These are priced from $2000 and are about the size and shape of a portable typewriter. IRRIGATE records a field's soil moisture status since planting and answers the important questions of when and how much water should be applied in future irrigations. IRRIGATE is designed to be user oriented. IRRIGATE can be used with a wide variety of irrigation systems, with nine commonly grown area crops, with eight common soil types and with a minimum of climatic data (maximum and minimum temperature only) if necessary. The irrigation scheduling for about 25,000 acres was handled through IRRIGATE and AGNET in 1977. (Skogerboe-Colorado State)
W79-04188

BETTER WATER USE, SAY TEXANS,
J. Blair.
Irrigation Age, Vol. 12, No. 6, p 26, March 1978.

Descriptors: Water conservation, Irrigation wells, Texas, *Irrigation efficiency, Grain sorghum, Cotton, Drought resistance, Surface irrigation, Sprinkler irrigation.

Irrigation on the Southern High Plains will continue the trends started a few years ago when production costs escalated. There will be greater emphasis on irrigation efficiency, more timely watering, fewer irrigations, and a slow-down in buying of new equipment. Also there will be a shift in crop acreages, with some of the corn and wheat land being in milo and cotton. Consensus of opinion of the farmers is that despite higher irrigation costs most farmers will pump the wells in 1978. But there will be continued improvement in pumping efficiency, more water conservation methods used, more dependence on rainfall and a shift to drought resistant crops, such as cotton and grain sorghum. (Skogerboe-Colorado State)
W79-04191

DRIP AND/OR SPRINKLER,
Olson Engineering Systems, Indio, CA.
B. R. Olson, Jr.
Irrigation Journal, Vol. 28, No. 3, p 46-47, May-June, 1978.

Descriptors: Water conservation, Irrigation systems, *Sprinkler irrigation, Irrigation water, Filtration, *Drip irrigation.

The purpose of this report is to discuss the various aspects of drip irrigation system associated with its applicability and how it compares with sprinkler irrigation system. (Skogerboe-Colorado State)
W79-04192

DEVELOPMENT OF AGRICULTURAL IRRIGATION IN THE FEDERAL REPUBLIC OF GERMANY,
Federal Ministry of Food, Agriculture and Forestry, Bonn (Germany, F.R.).
K. Zanker.
ICID Bulletin, Vol. 27, No. 1, p.85-88, January, 1978. 3 tab, 4 ref.

Descriptors: *Irrigation systems, *Sprinkler irrigation, Water conservation, Water shortage, Germany.

Although the Federal Republic of Germany is situated in the temperate zone and owing to its quite high rainfall has no real water shortage in the strict sense of the term, modern irrigation methods do however offer the possibility of using the available water supply more rationally and more economically. This is particularly true for years with low rainfall. In granting new water rights, the authorities should strive to reserve the supply of ground water primarily for drinking purposes. In most cases for irrigation, surface water or effluent is sufficient (the latter of course subject to standards of hygiene being met). The results of the present paper can be usefully applied to areas where a real water shortage exists-arid and semi-arid zones of the earth. The more economical use of water available, made possible by more modern irrigation methods, which can lead to a considerable saving of water, can be of great importance, especially when water is in particularly short supply. (Skogerboe-Colorado State)
W79-04194

DRAINAGE AND THE CENTER PIVOT SPRINKLER METHOD OF IRRIGATION,

Valmont International, Valley, NE.
A. A. Alvi.
ICID Bulletin, Vol. 27, No. 1, p. 76-78, January, 1978. 7 ref.

Descriptors: *Sprinkler irrigation, Drainage, Flood irrigation, Salinity.

The surface method of flood irrigation is a source of drainage problems and it also does not provide controlled amounts of water to crops as and when required. The Center Pivot Sprinkler method of irrigation helps to solve these problems and has some other additional advantages. This method of irrigation in combination with integrated drainage construction is hoped to meet growing needs of food and fiber for the increasing world population. (Skogerboe-Colorado State)
W79-04195

DRIP IRRIGATION-CHEMICAL, PHYSICAL WAYS TO KEEP EMITTERS OPEN,
Crops and Soils Magazine, Vol. 30, No. 6, p 15-18, March, 1978. 9 fig.

Descriptors: Maintenance, Clogging, *Irrigation systems, Water conservation, Chemical precipitation, *Drip irrigation.

The most serious problem in drip irrigation is plugging of emitters caused by chemical or biological buildup in minute water passageways. Preventing that buildup is a key to successfully operating most drip irrigation systems. Researchers at Yuma and Phoenix, Arizona approached the clogging problem and reclaimed old drip lines by adding dilute H2SO4 and hypochlorite solution (laundry bleach) to the irrigation water entering the lines. After the initial 'slug' treatment, the emitters were operating at 95% of the designed flow. After the 24- to 36-hour treatment, the entire system was treated with lower concentrations of chlorine and acid, keeping the system at about 1 ppm chlorine and a pH of 7. That continuous treatment maintained satisfactory emitter performance, not only in the older lines but in a newly installed system. More research is being done to expand guidelines for maintaining emitter performance. (Skogerboe-Colorado State)
W79-04196

COMPUTER SCHEDULING CAN SAVE MORE WATER,
Irrigation Age, Vol. 12, No. 6, p 17, March, 1978.

Descriptors: Irrigation programs, Scheduling, *Irrigation efficiency, *Water conservation, Computer models, Computer programs, Nebraska, *Irrigation systems.

It is reported that scheduling of irrigation water application through the use of electrical resistance blocks to determine soil moisture content, with data feedback to a computer system, can save up to 38% of the water and energy being used in most irrigation operations without reducing yields. One such irrigation scheduling computer program developed at the University of Nebraska-Lincoln has been discussed in this report. (Skogerboe-Colorado State)
W79-04198

UNDER-TREE IRRIGATION SYSTEM.
Irrigation Journal, Vol. 28, No. 3, p 34, May-June, 1978.

Descriptors: Irrigation systems, *Sprinkler irrigation, Drainage, Leaching, Israel.

A paper entitled 'Irrigation in the 21st Century-Today', which appeared in the May/June 1976 issue of the Irrigation Journal, dealt with the advantages of the Micro Jet and referred to it as the irrigation system of the future. The purpose of this paper is to describe an Israeli emitter, or minisprinkler which has been in operation for a number of years and also shows a great potential for the future. (Skogerboe-Colorado State)
W79-04199

DRIP SYSTEMS STANDARDS AND SPECIFICATIONS.
Irrigation Journal, Vol. 28, No. 3, p. 12-13, 32, May-June, 1978.

Descriptors: *Drip irrigation, *Standards, Specifications, Irrigation systems, Irrigation design.

These standards and specifications of drip irrigation systems outlined by the Florida Irrigation Society contains useful information and guidelines for the irrigation industry. (Skogerboe-Colorado State)
W79-04200

STANDARDS FOR THE CALCULATION OF IRRIGATION EFFICIENCIES,
ICID Committee on 'Assembling Irrigation Efficiency Data'.
ICID Bulletin, Vol. 27, No. 1, p. 91-101, January, 1978. 6 tab, 6 equ.

Descriptors: *Standards, *Irrigation efficiency, Irrigation ditches, Irrigation canals, Irrigated land, Irrigation design.

The efficient management of irrigation water is becoming more important as the competition for water of good quality grows ever keener with the world's increasing population. Reliable measurements of water are vital in preventing wastage and in the attainment of maximum beneficial use. Measurements should be made and records kept of all water flowing into and through the supply system and of all deliveries made from the system. Discharge measurements should be made as accurately as is practicable and action should be taken to restrain overdelivery. The purpose of this paper is to lay down a standard procedure for assessing efficiency of water use in conveyance, distribution and field application operations. (Skogerboe-Colorado State)
W79-04201

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: I. THEORY,
California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 2G.
W79-04202

TRANSIENT CHANGES IN THE SOIL-WATER SYSTEM FROM IRRIGATION WITH SALINE WATER: II. ANALYSIS OF EXPERIMENTAL DATA,
California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 2G.
W79-04205

PREDICTION OF PHOSPHORUS DIFFUSION FROM FERTILIZER SOURCE,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2K.
W79-04208

DISPOSITION OF 15N-LABELED FERTILIZER NITRATE APPLIED DURING CORN CULTURE IN FIELD LYSIMETERS,
Science and Education Administration, Temple, TX. Grassland-Forage Research Center.
F. W. Chichester, and S. J. Smith.
Journal of Environmental Quality, Vol. 7, No. 2, p 227-233, April-June, 1978. 3 fig, 5 tab, 21 ref.

Descriptors: *Nitrates, Fertilizers, *Denitrification, Leachate, Runoff, Nitrogen cycle, Lysimeters, Sweet corn.

Calcium nitrate labeled with 5.5% 15N was applied at 336 kg/ha nitrogen (N) to each of two conventional tillage and two mulch minimum tillage field lysimeters continuously cropped to corn (Zea mays L.). Disposition of the labeled N was followed for 3 years, particularly relative to its effect on water quality. An accounting of applied 15N for the study period showed that <2% moved in runoff, approximately 30% was leached in percolate, 25 to 30% was recovered by the corn crop, and from 10 to 30% remained in the soil. On the basis of a balance sheet constructed from the data, 15N gaseous loss (presumably mainly by denitrification) was estimated to range from 6 to 26% of that applied. The magnitude of gaseous loss of N appeared to vary as a function of lysimeter management history, with the systems under improved soil fertility management exhibiting less gaseous loss due to greater immobilization of 15N in the soil organic fraction. (Skogerboe-Colorado State)
W79-04223

A KINEMATIC MODEL FOR SURFACE IRRIGATION,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2G.
W79-04230

INHIBITION OF UREASE ACTIVITY BY HETEROCYCLIC SULFUR COMPOUNDS,
Alberta Univ., Edmonton. Dept. of Soil Science.
For primary bibliographic entry see Field 2K.
W79-04233

RESIDUAL FERTILIZER NITROGEN IN A FLOODED RICE SOIL,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-04237

SODIUM BICARBONATE EXTRACTION TO ESTIMATE NITROGEN, PHOSPHORUS, AND POTASSIUM AVAILABILITY IN SOILS,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Div. of Soil Chemistry and Plant Nutrition.
For primary bibliographic entry see Field 2G.
W79-04238

A TECHNIQUE FOR ASSESSING SEEDLING EMERGENCE UNDER DROUGHT STRESS,
Utah Agricultural Experiment Station, Logan.
D. A. Johnson, and K. H. Asay.
Crop Science, Vol. 18, p 520-522, May-June, 1978. 1 fig, 1 tab, 17 ref.

Descriptors: *Seedling emergence, *Germination, *Crop response, *Drought resistence, *Wheatgrasses, *Moisture stress, Genetics, Plant breeding, Planting management, Grasses.

Germination and emergence in low rainfall, drought stressed regions is a critical problem in the establishment of many crops. Accordingly, the development of a technique to determine seedling emergence under drought stress is described here as it was used in a plant breeding study to screen large seedling populations for emergence potential under drought stress. A modified Kaufman soil-solute germination technique is described that avoided direct seed and osmoticum contact, allowed for the maintenance of a wide range of soil water potentials and was capable of determining the emergence potential of a large number of seedlings. Application of the technique to 120 lines of crested wheat grass - Agropyron desertorum, A. cristatum, and A. sibiricum, indicated significant differences in seedling emergence at two water stress levels with the greatest genetic variance occurring under the most severe drought-stressing conditions. The difference among progenics, however, were not consistent under the two stress levels as indicated by a highly significant progeny X stress level interaction and a significant, but low, correlation (R=0.40) between drought stress levels. Although selection for seedling emergence would then be expected to produce different results under the two moisture stress levels, some progenies emerged well consistently under both treatments. Genetic improvement opportunities appear to be greatest under the more severe

drought stress treatment although it is suggested that selection be made under the range of moisture regimes to which the variety is most likely to be subjected. (Tickes-Arizona)
W79-04280

PERSPECTIVES ON DESERTIFICATION,
New South Wales Univ., Kensington (Australia).
J. A. Mabbutt.
Economic Geography, Vol. 53, No. 4, p 317-321, Oct. 1977. 12 ref.

Descriptors: *Dry farming, *Land management, *Land reclamation, *Desertification, *Political constraints, *Planning, Arid lands, Climatic zones, Land development, Land resources, Social effects, Water resources development, Water management(Applied), Productivity.

Various preceptions of the problem of desertification are reviewed here to illustrate the often conflicting views as to the potential and proper utilization of the worlds dry lands. For many, these water-stressed areas are considered inhospitable, infertile, and uncertain habitats which can be occupied and made productive only by adjustments which entail great physical, social, or economic costs to their inhabitants. On the other hand, there are those who content that dry lands have good potential and that their underproductivity cannot be tolerated in an increasingly hungry and demanding world. It is the author's contention that people tend to find the kind of evidence they seek and neither of the opposing views have so far been supported by careful estimates of the numbers of people that dry lands might safely support in the near future. Whatever course of action is followed, it is argued here that failure will result unless measures are made to relate to the problems as they are perceived by the local residents of the area in question. (Tickes-Arizona)
W79-04282

A WINNING BATTLE AGAINST DESTRUCTION,
Desert Inst., Ashkhabad (USSR).
A. G. Babaev, and N. S. Orlovsky.
Unesco Courier, p 17-22, July 1977. 4 fig.

Descriptors: *Project post-evaluation, *USSR, *Irrigation systems, *Canals, Project purposes, Alternate planning, Project benefits, Multiple-purpose projects, Research and development, Water conservation, Agricultural engineering, Structural design, Construction, Land management, Irrigation canals, Desalination plants, Water, Delivery.

Through research and development, the arid regions of the Soviet Union, covering two and one-half million sq. km., have become some of the most productive areas of the country. Settlement and intelligent grazing patterns have replaced traditional nomadic practices that once led to widespread destruction of potentially arid lands. The Golodnaya project, Yaskhansky pipeline, the Dzhezkazgan copper works, and the Shevchenko desalination project have transformed a once barren region covering millions of hectares into a diversified and productive agricultural region through construction of modern water delivery and treatment works. These projects are small, nevertheless, in comparison with the construction of world's largest desert irrigation project, the Karakum Canal. This ship-carrying canal, already responsible for half of the Turkmen SSR's crop of cotton, will eventually irrigate more than a million hectares. These projects, by reclaiming literally the whole of the Soviet Union's arid lands, have changed a once-harsh environment into a diverse and progressive region upon which the country has grown to depend. (Tickes-Arizona)
W79-04284

GROWTH AND YIELD OF JOJOBA PLANTS IN NATIVE STANDS USING RUNOFF-COLLECTING MICROCATCHMENTS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
W. L. Ehrler, D. H. Fink, and S. T. Mitchell.
Agronomy Journal, Vol. 70, p 1005-1009, Nov.-Dec., 1978. 6 fig, 1 tab, 13 ref.

Descriptors: *Water harvesting, *Runoff, *Surface sealing, *Jojoba, *Microcatchments, Arid climates, Rainfall-runoff relationships, Water conservation, Water yield, Xerophytes, Crop response, Soil-water-plant relationships, Soil moisture.

Water harvesting catchments were established around a marginal water-stressed stand of Jojoba in the Usery Mountains east of Phoenix, AZ., to improve plant growth and seed yield of a native Jojoba stand by using simple water-harvesting techniques to increase the available water and to better understand Jojoba-soil-water relationships. The 1-ha study site was divided into three treatment areas containing a total of 30 small indigenous female bushes. Rainfall, runoff, soil moisture, relative leaf water content, plant volume and seed yield were measured in each of the three treatment areas which included: (1) surface treatment with a water repellant coating, (2) clearing, smoothing and rolling, and (3) no water harvesting catchment or surface conditioning. Plant volume increased an average of 43, 44, and 237% for no treatment, cleared, smoothed and rolled, and water repellant coating areas respectively over a four year period. Plant seed yields increased 27, 26, and 208 g/plant for the respective treatments in 1977 although frost damage severely limited production in 1975 and 1976. It was concluded that this study demonstrated the feasibility of using simple water harvesting techniques to significantly increase Jojoba seed yield on native plant stands. (Tickes-Arizona)
W79-04288

LAND TENURE, HAZARDS, AND THE ECONOMY: VITICULTURE IN THE MENDOZA OASIS, ARGENTINA,
Valporaiso Univ., IN.
R. A. Hansis.
Economic Geography, Vol. 53, No. 4, p 368-371, Oct. 1977. 4 ref.

Descriptors: *Argentina, *History, *Risks, *Viticulture, *Land tenure, Economic feasibility, Economic impact, Arid lands, Land management, Land use, Melt water, Waterlogging, Water supplies, Water management(Applied), Water shortage, Saline soils.

The problems of desertification as exemplified by waterlogging of soils, salinization, uncertain rainfall, and variability of crop production is endemic throughout the arid world. This author has described the impact of these environmental factors on a small group of farmers in the arid Mendoza region of Argentina, tracing the increase in grape production there when mass migration from grape-growing regions of Europe took place at the turn of the century. Water in the area was and is the limiting factor, with only 150-200 mm annual precipitation. Meltwater from the Andes and other surface waters is distributed by an elaborate network of canals and ditches but even such a system cannot withstand fluctuations in prices superimposed on the physical problems of shortages of water and the degradation of the soil. These physical and economic hazards traditionally experienced by small subsistence farmers everywhere should alert the international umbrella organizations to the need for a deeper understanding of these problems and for recognition of the steps necessary to overcome them. (Tickes-Arizona)
W79-04291

EFFECTS OF PLANTING CONFIGURATION ON WATER USE AND ECONOMICS OF DRIP IRRIGATION SYSTEMS,
Central Arid Zone Research Inst. Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
S. D. Singh.
Agronomy Journal, Vol. 70, No. 6, p. 951-954, Nov.-Dec., 1978. 2 fig, 2 tab, 6 ref.

Descriptors: *Drip irrigation, *Irrigation design, *Irrigation efficiency, *Irrigation systems, *Cost analysis, Economic feasibility, Pipelines, Water distribution(Applied), Soil-water-plant relationships, Crop response, Irrigation effects, Irrigation engineering, India.

This study evaluates the effect of different planting configuration in crop performance, produce quality, and savings in the cost and in the amount of water used. Field experiments were conducted on a loamy soil in the arid region of Rajasthan, India. The treatments comprised four planting geometries: (1) 60cm. x 25cm. rectangular, (2) 25cm. square, (3) 18.75cm. hexagonal and (4) 25cm. equilateral, which were evaluated in separate experiments on four crops: cabbage, cauliflower, tomato, and turnip. The rectangular and hexagonal planting configurations resulted in single, double and triple row configurations and required 4, 2, and 1 drip lateral per 2.40 M plot width respectively. Results indicated that the yield and quality of produce was the same in both double and single row configuration, suggesting a possible 50% reduction in cost and water use. Cost and water use were reduced 75% with the hexagonal configuration but resulted in a 26-52% reduction in yields compared to the rectangular. Tomato was the one crop unaffected by hexagonal configuration, indicating that the cost and water use of tomato production can be cut in half with the proper drip irrigation design and planting configuration. (Tickes-Arizona)
W79-04302

WATER ECONOMY AND SALINE WATER USE BY DRIP IRRIGATION,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
S. D. Singh, J. P. Gupta, and P. Singh.
Agronomy Journal, Vol. 70, No. 6, p. 948-951, Nov.-Dec., 1978. 3 tab, 2 fig, 10 ref.

Descriptors: *Irrigation practices, *Irrigation efficiency, *Drip irrigation, *Soil-water-plant relationships, *Crop response, Furrow irrigation, Irrigation effects, Irrigation water, Evapotranspiration, Water requirements, Saline water, Rates of application, Water utilization, Soil water, Arid lands.

This study evaluated (1) the relationship between yield and amount of water applied by drip and furrow methods, (2) the potential of using poor quality water for the irrigation of vegetable crops by drip irrigation, and (3) distribution of water and salts in soil with drip irrigation. Field tests were conducted during 1972-73 and 1973-74 on a loamy sand soil to analyze the effects of irrigation with sweet and saline waters applied by drip and furrow methods on the yield of potatoes. Experimental drip irrigation treatments included: (1) drip irrigation equal to ET, (2) equal to 75% of ET, (3) equal to 50% of ET, (4) with saline water equal to ET, and (5) furrow irrigation equal to ET. Drip irrigation at a rate equal to 1.0 ET was also evaluated with tomatoes. Results indicated that drip irrigation at a rate less than ET decreased the yield of potatoes compared with the rate equal to ET, and required 50% less water than furrow irrigation obtaining the same yields. Saline water of 3,000 mhos/cm. applied by drip irrigation caused no yield reduction but at 10,000 mhos/cm. a 91% reduction in potatoes and 35% reduction in tomatoes was found. Soil water was found to be 15% beneath the emitter, 7% 20cm. from the lateral, and 3 to 4% near the wetting front 40cm. from the lateral. Salts were concentrated in the surface 15 to 20cm. midway between the emitters and toward the wetting front. (Tickes-Arizona)
W79-04303

VALUE OF DRIP IRRIGATION COMPARED WITH CONVENTIONAL IRRIGATION FOR VEGETABLE PRODUCTION IN A HOT ARID CLIMATE,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
S. D. Singh, and P. Singh.
Agronomy Journal, Vol. 70, No. 6, p 945-947, Nov.-Dec., 1978. 1 fig, 2 tab, 9 ref.

Descriptors: *Drip irrigation, *Irrigation practices, *Irrigation efficiency, *Soil-water-plant relationships, Irrigation operation, Maintenance, Irrigation

design, Irrigation systems, Applied water distribution, Flood irrigation, Sprinkler irrigation, Furrow irrigation, Water quality, Arid lands, Evapotranspiration, Climatology, Vegetable crops, Timing.

This study evalutes drip, sprinkler, and furrow irrigation methods with respect to yield and water-use efficiency, using the same rate of water application and the same mode of fertilizer application but with different irrigation frequencies. The test crops used in this analysis were long gourd, ridge gourd, watermelon and round gourd planted in a loamy sand with sand, silt and clay content at 85.2, 4.8 and 9.9% respectively. With drip and sprinkler methods water was applied daily in amount equal to 68% of the evaporation from a class A pan, while furrow and overhead techniques commenced when the cumulative total evapotranspiration reached 3.2cm. The pattern of yield accumulation of the four crops under these three methods were different and the benefits of drip irrigation were not the same for all crops. Accumulation rates for drip irrigated crops showed trends toward rapid growth toward the end of the growing season and long gourd increased in yield by 45-47%, round gourd by 21-38% and watermelon by 10-22% compared with sprinkler and furrow techniques. Additionally, water use efficiency with drip irrigation was nearly twice that of other techniques. It is concluded that drip irrigation has the potential to increase yield for most if not all vegetable crops. (Tickes-Arizona)
W79-04304

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

STATION TIMING SELECTION CIRCUIT FOR IRRIGATION CONTROLLER,
Clemar Mfg. Corp., Azusa, CA. (Assignee).
R. L. Ruggles.
U.S. Patent No. 4,121,114, 7 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 975, No 3, p 1198, October 17, 1978.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Control systems, Sprinkler irrigation, Irrigation efficiency, Remote control, Electronic equipment, Drip irrigation.

In many applications there is a requirement for a mixture of short-term spray irrigation and long-term drip irrigation of shrubs, and it is highly desirable to be able to selectively assign various shrub irrigation valves as either spray or drip irrigation stations. This invention is directed to these ends. It is an improved irrigation controller in which provision is made for selectively designating stations for either short-term or long-term irrigation. The improvement includes an additional capacitor connectable in parallel with the timing capacitor of the system, and means for automatically switching the capacitor into connecton with the timing capacitor for selected stations. (Sinha-OEIS)
W79-04462

ROTARY SPRAYING DEVICE PARTICULARLY USEFUL FOR WATER IRRIGATION,
M. Drori.
U.S. Patent No. 4,121,769, 9 p, 18 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1442, October 24, 1978.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Application equipment, Nozzles.

A rotary liquid spraying device comprises a nozzle and a liquid spraying head rotatably mounted to the nozzle, the spraying head including an internal chamber having a shaped inlet orifice receiving the jet from the nozzle, and a number of outlet orifices which produce lateral jets and a reaction force for rotating the head. The internal chamber is of substantially larger cross-sectional area than either the inlet, or all the outlet orifices together, to define a reservoir in which the velocity of the nozzle jet is substantially reduced and is used to pressurize the liquid before it is issued at a high velocity through the outlet orifices. The shaped inlet orifice includes side walls converging towards each other in the direction of the inlet chamber and terminating in a narrow diameter throat at the mouth of the chamber. (Sinha-OEIS)
W79-04466

DRIP IRRIGATION EMITTER,
R. L. Hendrickson.
U.S. Patent No. 4,121,771, 5 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1443, October 24, 1979.

Descriptors: *Patents, *Irrigation, *Irrigation practices, *Irrigation efficiency, Application equipment, Soil-water-plant relationships, Water delivery, Drip irrigation.

A drip irrigation emitter or device comprises a flow restrictor helical thread on the outside of a main body, and a cap member that fits over the thread. Water is supplied to the interior of the main body and must flow through a narrow, annular passageway formed by the cap before the water flows through provided restrictor orifices, so no large particles are carried into the orifices or the helical thread to minimize plugging. The water discharges adjacent to the water tube or hose to minimize root intrusion into the irrigation device, and baffles also are provided to minimize root intrusion. The cap can be loosened or removed to flush the thread if foreign material enters the thread. (Sinha-OEIS)
W79-04467

MEANS AND METHOD OF INSTALLING EMITTERS IN IRRIGATION TUBING,
L. Spencer.
U.S. Patent No. 4,122,590, 6 p, 8 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1718, October 31, 1978.

Descriptors: *Patents, *Irrigation, *Application equipment, Irrigation practices, Irrigation efficiency, Tubes, Conduits, Drip irrigation, Emitters, Manufacturing.

In the development of drip irrigation, it has become feasible to utilize a thinwall irrigation tube capable of being flattened and compactly rolled to minimize storage and shipping space. This invention describes means and a method of installing emitters in irrigation tubing, wherein a core assembly dimensioned for ready insertion in a thinwall irrigation tube is provided with internal rollers which are confronted by fixed external rollers positioned to function through the walls of the tubing so as to retain the core assembly in a fixed position as the tubing is moved between the internal and external rollers. The core assembly includes an anvil periodically engaged by an external radially moving cutting tool to form in the tubing a series of emitter receiving perforations. The core assembly also includes a fork member for spacing the perforated wall of the tubing from the opposite wall to facilitate reception of emitters forced by an external mandrel. The anvil and fork and their respective cutting tool and mandrel are adapted to be spaced at preselected distances depending on the required emitter spacing. (Sinha-OEIS)
W79-04475

IRRIGATION WATER MOVEMENT BELOW THE CORN ROOT ZONE IN CRETE SILT LOAM,
Kansas State Univ., Manhatten. Evapotranspiration Lab.
For primary bibliographic entry see Field 2G.
W79-04483

RESPONSES OF SEVERAL FORAGE AND FIELD CROPS TO SUBSURFACE SOIL WARMING AND SEWAGE EFFLUENT SPRAY IRRIGATION,
The Pennsylvania State Univ., University Park. Dept. of Agronomy.
G. A. Mellish.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 343, Price codes: A08 in paper copy, A01 in microfiche. Master of Science thesis, 166 p, 21 fig, 29 tab, 58 ref. August 1978. OWRT C-6249(No 5222)(3), 14-34-0001-5222.

Descriptors: *Sewage effluents, *Soil temperature, Cold resistance, Pest control, Soil moisture, Sudangrass, Orchardgrass, Switch grass, Alfalfa, Winterkilling, Mature growth stage, Forage grasses, Field crops, *Irrigation effects, Soil warming.

The influence of soil warming and sewage waste water irrigation on winter survival, maturation, yield, quality, and pest relationships of various crops was evaluated. An electric power plant-soil warming system was simulated by circulating hot water from an oil-fired boiler through a pipe network buried at a 30-cm depth and 60-cm spacing. Treatments consisted of soil temperature regimes which were approximately 13 and 9C above average annual ambient soil temperatures at the 15-cm depth and an ambient soil control. Treatment areas were spray-irrigated with treated sewage waste water twice weekly. Four cropping systems were used. Soil warming delayed the development of autumn cold tolerance in alfalfa, winter wheat, and winter barley and reduced cold tolerance attained by the winter cereal crops. Soil warming stimulated early spring growth and increased the rate of maturation of most crops. Yield responses to soil warming varied with type of crop. Forage quality differences between crops grown on heated and ambient temperature soils were primarily associated with chronological tissue age at harvest. Certain insect species appeared earlier on heated than on ambient plots. Annual and perennial crops could be grown on heated and waste water irrigated soil in the Northeast and double cropping would be more feasible than with a conventional agricultural system. (Sink-Penn State)
W79-04489

THE EFFECT OF COMBINED SOIL WARMING AND IRRIGATION ON THE SOIL SURFACE ENERGY BUDGET,
The Pennsylvania State Univ., University Park. Dept. of Meteorology.
For primary bibliographic entry see Field 2G.
W79-04490

ECONOMICALLY OPTIMUM IRRIGATION PATTERNS FOR GRAIN SORGHUM PRODUCTION: TEXAS HIGH PLAINS,
Texas A and M Univ., College Station. Dept. of Agricultural Economics.
L. R. Zavaleta, R. D. Lacewell, and C. R. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 344, Price codes: A06 in paper copy, A01 in microfiche. Texas Water Resources Institute, Texas A and M University Project Report TR 100, 103, 2 fig, 14 tab, 66 ref, append, January 1979. OWRT A-037-TEX(4), 14-34-0001-7091, 7092 and 8046.

Descriptors: *Irrigation practices, *Sorghum, *Model studies, Irrigation efficiency.

Agricultural production and associated economic effects of irrigation on the Texas High Plains are seriously threatened by a rapidly declining groundwater supply and a swift upward trend in energy costs. To optimize the amount of irrigation water to be applied during specified periods of the production process, a stochastic openloop feedback control policy was built into a grain sorghum growth simulation model. Model application indicates that to maximize net returns, producers will follow a policy of frequent irrigations with smaller applications than currently practiced. The results provide implications for improved water management by the producer and opportunities for irrigation research. Fuel curtailment analysis suggested both the length of curtailment and timing significantly affected expected yield and net returns.
W79-04495

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
M. S. Jennings, G. H. Toebes, G. E. Staab, and A. R. Rao.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 847, Price codes: A05 in paper copy, A01 in microfiche. Report CE-HSE-78-1, October 1978. 92 p. OWRT B-094-IND(2).

Descriptors: *River flow, *Gaging stations, *Data collection, *Flow rates, Streamflow, Water levels, Gradients, Basic data collection, Model studies, Systems operation, Algorithms, *Kentucky, *River stages, *Strip charts, Stope stations, *Green River Basin(KY), Data base, Adjustment algorithms.

Strip chart recordings of river stages in the Green River Basin, KY., were digitized. The purpose was to obtain average flows over 6-hour periods, a time-step desired for the system operation of four Corps of Engineers reservoirs in the basin. It proved necessary to prepare and use a program called STGFLW to (1) convert gage-heights into mean discharges, (2) to format, store and plot data, (3) to obtain sufficient accuracy, (4) to guard against errors, and (5) to make needed checks and adjustments. A program listing, User's Manual as well as a Programmer's Manual are included.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
S. Stevens, A. R. Rao, G. H. Toebes, and A. Chossiakos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 845, Price codes: A08 in paper copy, A01 in microfiche. Report CE-HSE-78-2, October 1978. 159 p. OWRT B-094-IND (3).

Descriptors: Reservoir operation, *Reservoir management, *Data storage and retrieval, Reservoir releases model studies, *Kentucky, *Reservoir operation data, Data base specifications, Real-time reservoir systems operation, *Green River(KY).

A formal data base management system was developed for use in reservoir operations model development. Time series of reservoir elevations and discharges, of temperature and precipitation, and of stream stages and discharges for the Green River Basin, KY. were collected and stored. Efficient programs for data addition, data editing, data retrieval, and data base commenting were developed. A User's Manual and Programmer's Manual are included. In addition to its utility in model construction, the data base may be useful when satellite and/or radar data increase the input data management problem in real-time reservoir system operation using a comprehensive simulation model.
W79-04009

RESERVOIR SEDIMENTATION AS A FUNCTION OF PRECIPITATION VARIABILITY,
Maryland Univ., Baltimore. Dept. of Geography.
For primary bibliographic entry see Field 4D.
W79-04061

URBAN FLOOD MANAGEMENT: PROBLEMS AND RESEARCH NEEDS,
North Carolina State Univ. at Raleigh.
D. H. Howells.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. WR2, p 193-212, November 1977. OWRT B-062-NJ(14), 14-31-0001-5134.

Descriptors: *Flood control, Flood damage, Flood plain insurance, Flood plain zoning, Research priorities.

Discussion and conclusions are presented of a 1975 panel on urban flood management at the Quail Roost Workshop on Reorientation of Urban Water Resources Research. Topics covered include the need for a restatement of national goals and objectives in terms relevant to state and local interests; standards of performance; Federal, state, and local interactions as they affect the capacity of local government to carry out floodplain management; more exact and reliable techniques for floodplain delineation for land use regulation and flood insurance rates; and social and economic consequences of floodway fringe development under present national policy. Forty-two problem areas are listed for further identification and research.
W79-04089

DEVELOPMENT OF A DRAINAGE AND FLOOD CONTROL MANAGEMENT PROGRAM FOR URBANIZING COMMUNITIES--PART I,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
E. J. Riordan, N. S. Grigg, and R. L. Hiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 997, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No 85, September 1978. 64 p, 4 fig, 110 ref, 1 append. OWRT B-161-COLO(5). 14-34-0001-7112.

Descriptors: *Drainage programs, *Urban drainage, *Community development, Urbanization, Hydrology, Drainage patterns, Mathematical studies, Cost analysis, Cost allocation, Legal aspects, Project planning, Drainage basins, Drainage systems, Flood control.

An inexpensive, quick drainage management procedure for mitigating community development-induced drainage impacts is presented. The three major elements of a drainage management program are discussed: (1) the technical element establishes the method of flood hydrology calculation; (2) the financial element establishes methods for drainage and flood control cost calculation and cost allocation; and (3) the regulatory element establishes the enforcement mechanism of the drainage management program. The abbreviated planning methodology for calculating project costs, upon which this program is based, can reduce the front-end drainage planning costs by 75 to 80%. The program's cost apportionment method aids the community's financial situation regarding drainage management. It is thought that the total drainage management should be incorporated with effective legislation at the state level and within local subdivision regulations. (See also W79-04110) (Davison-IPA)
W79-04109

DEVELOPMENT OF A DRAINAGE AND FLOOD CONTROL MANAGEMENT PROGRAM FOR URBANIZING COMMUNITIES--PART II,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
E. J. Riordan, N. S. Grigg, and R. L. Hiller.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 998, Price codes: A11 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University, Completion Report No. 86, September 1978. 226 p, 22 fig, 16 tab, 110 ref, 3 append. OWRT B-161-COLO(5) Pt II, 14-34-0001-7112.

Descriptors: *Drainage programs, *Urban drainage, *Community development, Urbanization, Drainage patterns, Mathematical studies, Cost analysis, Cost allocation, Legal aspects, Project planning, Drainage basins, Flood control, Hydrology.

The three major elements of a drainage control program directed towards mitigating community-development generated induced drainage impacts of a recommended drainage management program are discussed in detail. Various hydrologic predictions used to evaluate development-induced drainage impacts are examined. The predictive capability of some rainfall-runoff models is compared through a statistical analysis of published results from those models, and the sensitivity of project analysis to poor runoff prediction is evaluated. The financial aspect of a drainage management system is developed through a review of the legal issues concerning municipal and developer liability, cost calculation, and cost apportionment. Existing cost calculation and cost apportionment methods are examined, and an engineering approach for apportioning drainage and flood control facility costs between developers and the municipal government was developed. Pertinent legal issues and existing U.S. Drainage Ordinances are discussed regarding the necessary changes that must occur in order to enforce the proposed drainage management system. (See also W79-04109) (Davison-IPA)
W79-04110

ESTIMATING PEAK DISCHARGES IN SMALL URBAN HAWAIIAN WATERSHEDS FOR SELECTED RAINFALL FREQUENCIES, KANE'OHE WATERSHED, O'AHU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2B.
W79-04126

HYDROLOGIC AND WATER QUALITY MODELING OF SURFACE WATER DISCHARGES FROM MINING OPERATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W79-04134

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME I: MAIN REPORT.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 4D.
W79-04139

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME IV, APPENDICES E THROUGH J, REPORTS OF COORDINATING AGENCIES.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6G.
W79-04141

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04143

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI VOL. 1, MAIN REPORT.
White River Basin Coordinating Committee.
For primary bibliographic entry see Field 6G.
W79-04146

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI VOL. VI: APPENDIX P - PLAN FORMULATION.
White River Basin Coordinating Committee.
For primary bibliographic entry see Field 6G.
W79-04147

FLOOD PLAIN INFORMATION: BUXTON CREEK AND TRIBUTARIES, DEQUINCY, LOUISIANA.
Army Engineer District, New Orleans, LA.
For primary bibliographic entry see Field 2E.
W79-04150

FLOOD PLAIN INFORMATION: SIXMILE CREEK--VICINITY OF PUEBLO, COLORADO.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-04151

RECORD FLOODS IN SOUTHWEST VIRGINIA, APRIL 1977.
Virginia State Water Control Board, Richmond; and Virginia Office of Emergency Services, Richmond.
For primary bibliographic entry see Field 2E.
W79-04153

TAILORING A PUMP FOR FARM USE,
J. Sass Metto.
Agri-book Magazine, Vol 5, No 1, p 24-25, 1979. 4 fig.

Descriptors: *Drainage engineering, *Pumps, *Farm management, Farm equipment, Tile drainage, Drainage systems, Land use.

Where gravity drainage is impossible or uneconomical, drainage pumps are the only alternative. An inexpensive drainage pump system is described. It consists of a prefabricated sump and storage tank made of corrugated steel culvert pipe and can be installed in a day or less. The area to be drained determines the size of the pump to be selected. If the land is diked the resulting ditches provide extra storage and a larger area can be handled by a given size pump. Electricity is the best source of power and the pump should be located at the lowest part of the watershed. High land should be drained by gravity and separated from the low land to reduce the size and cost of the pumping system and remove the hazard of flooding the low land. The farm drainage pump will become increasingly important. As land costs go up, maximum efficiency will be demanded and land that has been pastured or followed will be required to produce crops. Tile drains on much of this marginal land will require pumping. (Purdin-NWWA)
W79-04245

SMALL MAMMAL HABITAT IN DIFFERENT-AGED CHAMISE-WEDGELEAF CEANOTHUS CHAPARRAL,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
J. I. Cavallaro.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 148, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, October 1978. 112 p, 13 fig, 13 tab, 2 append. 46 ref. (California Water Resources Center Project UCAL-WRC-W-490).

Descriptors: *Watershed management, *Habitats, *Mammals, *Chaparral, *Forest fires, Brushlands, Burning, Wildlife, Wildlife habitats.

Plots in chamise-wedgeleaf ceanothus chaparral which burned eight, fourteen, and twenty-five years ago were used to examine the vegetational and small mammal changes which occur in this vegetation type as time passes after a fire. Vegetation height and litter cover continually increased among the plots as the length of time increased since the last fire. Total shrub cover and vertical canopy density, however, only increased between the eight and fourteen year old plots. Between those two plots, the density of chamise stems and Gramineae litter cover decreased. Between the fourteen and twenty-five year old plots, the density of yerba santa and the relative cover of chamise decreased whereas the relative cover of wedgeleaf ceanothus and the ratio of live to dead leaf cover of wedgeleaf ceanothus increased. Kangaroo rats and deer mice prefer younger chamise-wedgeleaf ceanothus chaparral which has relatively little shrub cover. Kangaroo rats, in fact, occur only in habitats with less than about 50 percent shrub cover while deer mice also utilize habitats with greater shrub cover. When the shrub cover increases to about 75 percent as time passes after a fire, pinon mice and woodrats begin utilizing chamise-wedgeleaf ceanothus chaparral. Woodrat utilization of this vegetation type is further affected, however, by the presence of other shrub species. Woodrats preferred chamise-wedgeleaf ceanothus chaparral with greater cover of species such as scrub oak, deerbrush, poison oak and toyon. (Snyder-Calif Davis)
W79-04259

GROWTH AND YIELD OF JOJOBA PLANTS IN NATIVE STANDS USING RUNOFF-COLLECTING MICROCATCHMENTS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3F.
W79-04288

BIOLOGICAL CONTROL OF WATER WEEDS WITH PLANT PATHOGENS,
Florida Univ., Gainesville. Dept. of Plant Pathology.
T. E. Freeman, R. Charudattan, and K. E. Conway.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 308, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Florida, Publication No. 45, 1978. 70 p, 3 fig, 5 tab, 57 ref. OWRT A-033-FLA(6), 14-34-0001-8010.

Descriptors: *Biocontrol, Water weeds, Plant pathogens, *Aquatic weed control, Fungi, Waterhyacinth.

Plant pathogens have many characteristics that make them ideal candidates as biocontrols for aquatic weeds. They are: (1) numerous and diverse; (2) frequently host specific; (3) easily disseminated and self-perpetuating; (4) will not completely eliminate a host species; and (5) do not normally affect man or other animals. With these points in mind, a modest program was begun in 1970, with the object of the evaluation and subsequent use of plant pathogens as biocontrol agents for aquatic weeds. The program later was expanded. The program progressed rapidly considering the lack of initial background information. A considerable backlog of information about diseases affecting aquatic plants has been developed. The objective of the utilization of plant pathogens in biocontrol programs for at least one noxious aquatic plant is nearing fruition. Large-scale field evaluation of the fungus Cerospora romanii for control of waterhyacinth is warranted. An additional three or four organisms also should soon be evaluated. Also, an attempt was made to find and research diseases with biocontrol potential for other aquatic weeds. (Morgan-Fla)
W79-04311

NATIONAL FORESTS DO NOT HAVE RESERVED WATER RIGHTS FOR RECREATIONAL PURPOSES,
For primary bibliographic entry see Field 6E.
W79-04417

FREELAND V. DICKSON (LOWER LANDOWNER HAS NO RIGHT TO UNIMPEDED FLOW OF SURFACE WATER ONTO HIS LAND),
For primary bibliographic entry see Field 2F.
W79-04434

UNITED STATES V. STATE OF NEW MEXICO (IMPLIED RESERVATION OF WATER DOCTRINE HELD TO COVER ONLY AMOUNT OF WATER NECESSARY FOR THE PURPOSE OF THE RESERVATION),
For primary bibliographic entry see Field 6E.
W79-04453

AQUATIC HERBICIDES,
Nalco Chemical Co., Oak Brook, IL. (Assignee),
J. F. Vartiak, and G. E. Wortley, Jr.
U.S. Patent No. 4,123,249, 4 p, 5 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1942, October 31, 1978.

Descriptors: *Patents, *Herbicides, *Aquatic weed control, Application methods, Polymers, Water soluble polymers.

Aquatic herbicides may be improved in their activity by applying aquatic herbicides under water to the vegetation to be controlled in the presence of a minor amount of a water-soluble vinyl addition polymer which has a molecular weight of at least 10,000 and an inorganic salt capable of cross linking the water-soluble polymer. The water-soluble anionic polymers may be employed in conjunction with the aquatic herbicides in a variety of ways. In one of its simplest forms, it would be applied below the surface of the water through injection nozzles. The polymer and crosslinking agent in the form of a concentrated liquid would be metered into the herbicide pump where it is mixed with the herbicide just prior to where the feed line goes into the application nozzles. (Sinha-OEIS)
W79-04476

4B. Groundwater Management

HYDROLOGIC EVALUATION OF PART OF CENTRAL VOLUSIA COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
P. W. Bush.
Geological Survey Water-Resources Investigations 78-89 (open-file report), 1978. 50 p, 17 fig, 1 tab, 9 ref.

Descriptors: *Groundwater resources, *Water supply, *Withdrawal, *Urbanization, *Saline water intrusion, Model studies, Water wells, Aquifer characteristics, Groundwater movement, Groundwater recharge, Leakage, Wetlands, Water utilization, Water demand, Land use, Planning, Evaluation, Florida, *Volusia County, Floridan aquifer, Pinder-Trescott model.

Municipal wells close to the Atlantic Coast cannot be expected to supply the steadily increasing population of Volusia County, Florida, indefinitely without causing saltwater intrusion problems. Therefore, new wells will be drilled away from the coast. The source of water for the planned artesian aquifer well field will be leakage from the water-table aquifer above. A digital model of the leaky aquifer system indicates that long-term yield of about 20 million gallons per day can be expected without the cone of depression dropping low enough to cause saltwater intrusion. Some types of land development could remove potential recharge from the area. Model tests with decreased leakage indicate that a large amount of potential recharge water would have to be removed from the system to effect an appreciable lowering of the cone of depression. Lowering the recharge potential by 20 percent apparently would have little effect on the cone. Lowering the recharge potential by 60 percent would, according to the model, increase the maximum depth of the cone by 27 percent. Land development that would redistribute potential recharge, rather than drain it away from the system, would have little effect on the aquifer beneath the well field. (Woodard-USGS)
W79-04030

CONJUNCTIVE GROUND AND SURFACE WATER ALLOCATIONS: THE ECONOMICS OF A QUASI-MARKET SOLUTION,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W79-04078

ARTIFICIAL RECHARGE: PART II,
National Water Well Association, Worthington, OH.

T. E. Gass.
Water Well Journal, Vol. 33, No. 2, p 32-33, February, 1979.

Descriptors: *Artificial recharge, *Water spreading, *Groundwater recharge, Infiltration rates, Recharge ponds, Flooding, Furrow systems, Infilration, Streambeds, Settling basins, Clogging.

Surface spreading, the most common method of artificial recharge, relies on infiltration to be effective. Various factors which influence infiltration rate are listed. The types of surface spreading systems include: basins or ponds, ditch or furrow networks, flooding systems, and streambed modification. Before construction of a surface spreading system, a survey should be conducted to determine the best type of system for the site, potential effects on water quality and the hydrologic budget and possible changes in plant and animal life. Also, a pilot recharge system should be built to finalize design specifications and develop efficient operation and maintenance procedures. General engineering principles for construction of recharge systems are outlined. Recharge problems are caused by poor quality recharge water, changes in soil structure or soil biology, and mechanical clogging. Clogging can be reduced by constructing a settling basin behind the main basin. Both recharge basins and settling basins should be operated intermittently to allow time for drying. Alternative basins should be available to allow other basins to dry out. (Purdin-NWWA)
W79-04239

WATER SYSTEMS COUNCIL: A VARIETY OF SERVICES TO PUMP MANUFACTURERS AND THE WATER WELL INDUSTRY,
D. Jacuzzi.
Ground Water Age, Vol. 13, No. 5, p 20, 22. January, 1979.

Descriptors: *Trade associations, *Water systems, Water wells, Pumps, Water tanks, Pitless adapters, Marketing, Water users, Standards, Legislation, Education.

The structure and purposes of the Water Systems Council (WSC) are presented. The WSC advertising program is directed toward consumers planning or building homes since they are potential private well owners. Through the media of a newsletter and workshop program, WSC informs sanitarians, county agents and other influence groups about water systems. WSC also educates industry personnel with the WSC's 'Water Systems Handbook' which explains water system design, installation, and maintenance. WSC offers guides to market planning for water systems manufacturers through a shipment reporting program. In 1979, the market reseach service will conduct a survey of private wells in each state together with projections about future well drilling. The Technical Committee determines the Testing and Rating Standards which form the basis of the 'Certified Performance' program. The Government Relations Committee monitors and acts on legislation affecting water systems manufacturers issues. The Ground Water Council support in part by WSC, distributes films and literature to the industry and the public on ground water supply, wells and pumps. (Purdin-NWWA)
W79-04240

HEAT PUMP UPDATE.
For primary bibliographic entry see Field 6B.
W79-04246

WATER WELLS HELP TEXAS CITY SAVE MONEY.
For primary bibliographic entry see Field 6B.
W79-04247

OPTIMIZATION TECHNIQUES APPLIED TO GROUND-WATER DEVELOPMENT,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6A.
W79-04406

CARBONATE HYDROGEOLOGIC ENVIRONMENTS: THEIR RELATIONSHIP TO LAND USE, WATER RESOURCES DEVELOPMENT AND MANAGEMENT,
The Pennsylvania State Univ., University Park. Dept. of Geoscience.
R. R. Parizek.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 337, Price codes: A05 in paper copy, A01 in microfiche. Institute for Research on Land and Water Resources Pennsylvania State University Research Project Technical Completion Report, Feb. 1979. 95 p, 3 fig. A-005-PA(8), 14-34-0001-8040.

Descriptors: Carbonate rocks, Dolomite, Limestones, Karst, Groundwater, Surface-groundwater relationships, Water table, Water supply, Droughts, Industrial wastes, Land use, Wells.

The elementary problem of where to locate water wells to obtain consistent and maximum yields with least risk for a variety of carbonate rocks was first solved in 1965 as part of this continuing study. The research was initiated to determine the geologic, topographic and land-use factors which govern the occurrence, movement and recharge of groundwater. The interrelationship between surface water and groundwater was investigated and the chemical quality of groundwater for a terrain underlain by nearly 8,000 feet of folded and faulted carbonate rocks was examined. Further, the influences of drought, urbanization, industrialization and recreation related to the physical environment's response to these stresses were investigated. Solid and liquid waste disposal practices were of special concern and attempts were made to define the waste management site selection criteria required to protect important groundwater supplies from threats of pollution. Also of concern were the aspects of the geologic and hydrologic setting in guiding land-use planning to protect groundwater supplies from pollution. Use of fracture traces to locate highly productive water wells is now in wide use in Pennsylvania and elsewhere in the United States, and it is no longer restricted to carbonate rocks. (Tsong-Penn State)
W79-04494

THE USE OF BOUNDING WELLS TO COUNTERACT THE EFFECTS OF GRAVITY IN DIPPING AQUIFERS,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
T. E. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 345, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, May 1978, 85 p, 28 fig, 4 tab, 19 ref, 3 append. OWRT A-044-LA(1).

Descriptors: Underground storage, Groundwater storage, *Groundwater movement, Artificial recharges, Gravitational migration, *Injection wells, Bounding wells, Computer programs, *Aquifers.

Bounding wells can be used in a dipping system to effectively prevent the gravitational migration of an injected fluid whose density differs from that of the original aquifer fluid. A computer program was developed to predict the required bounding well flow rates. Bounding well flow rates can be chosen such that a balance exists between injection and production volumes, so that none of the fluid produced by the bounding wells will reach the biosphere. One of the parameters that affect bounding well flow rates is radius of the injected volume of fluid, hence the required bounding well rates change continuously during injection and production of the stored fluid.
W79-04496

4C. Effects On Water Of Man's Non-Water Activities

A CROSS-SECTIONAL INVESTIGATION OF THE DETERMINANTS OF URBAN RESIDENTIAL WATER DEMAND IN THE UNITED STATES, 1960 AND 1970,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 6D.
W79-04003

DUAL PURPOSE DETENTION BASINS AND SURVEILLANCE PROCEDURES IN URBANIZING WATERSHEDS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., and A. W. McIntosh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 989, Price codes: A03 in paper copy, A01 in microfiche. Final Technical Completion Report, January 1979. 29 p, 6 fig, 40 ref. OWRT A-048-NJ(6), 14-34-0001-9032.

Descriptors: Dams, Flood control, Streams, *Detention reservoirs, Multiple purpose projects, Land use, Environmental damage, *Urban runoff, Urbanization, Channel erosion, Monitoring, *Urbanizing areas.

This report covers two subjects, (1) consideration of the use of detention basins for reducing particulate pollution as well as flood retardation, and (2) a system of surveillance for problem evaluation in small urbanizing streams. Small detention basins, which are being built in large numbers to reduce flooding in rapidly urbanizing areas, may be modified to serve additionally the purpose of reducing runoff pollution, which also accompanies urbanization. Only slight reduction in local flood control effectiveness will be entailed by the modificaton, and the dual purpose basins will be more useful in aid of flood control further downstream than the single purpose locally-oriented sturctures. Runoff pollution from urbanizing areas is important to water quality planning, and occurs largely in particulate form. Tentative criteria for interim use are suggested. Conventional stream monitoring is ineffective for small streams because of their variability; and water quality analysis of storm events is too expensive for general use. A system of surveillance is described which provides for problem evaluation through biological surveys and selective physical data gathering.
W79-04077

TO SOLVE HIGHWAY AND FARM WATER MANAGEMENT PROBLEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
R. L. Smith, and C. J. W. Drablos.
Agricultural Engineering, Vol. 59, No. 2, p. 22-24, February, 1978. 4 fig.

Descriptors: *Highway effects, *Drainage, Drainage water, *Soil erosion, Sedimentation, Legal aspects, Soil conservation.

Wherever agricultural lands are crossed by highways, drainage interrelationships between the highway authorities and the adjoining landowners become complex. Engineering and legal judgment plays an important role in finding the satisfactory solutions to these problems. While it may be permissible to temporarily obstruct local highways with ponded water, eroded material, and debris, such conditions should not permanently exist on highways which are subject to heavy, high-speed traffic. And care must be exercised to reduce adverse effects on adjoining lands as a result of the highway facilities--for example, the diversion of water from natural water courses, the interception of subsurface drainage systems, the obstruction of the natural water flow. This paper discusses the various aspects of these problems and suggests how the magnitude of most problems can be re-

duced which will cause least disruption. (Skogerboe-Colorado State)
W79-04190

STORMWATER-RUNOFF DATA FOR A HIGHWAY AREA, BROWARD COUNTY, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Hardee, R. A. Miller, and H. C. Mattraw, Jr.
Geological Survey open-file report 78-612, June 1978. 166 p, 2 fig, 4 tab, 6 ref.

Descriptors: *Rainfall, *Rain gages, *Storm runoff, *Urban hydrology, *Water quality, Land use, Water pollution, Basic data collections, Water yield, Water analysis, Chemical analysis, Water quality control, Florida, *Pompano Beach area, *Broward County, Bulk precipitation.

Rainfall, stormwater runoff, and water-quality data are summarized for a highway area near Pompano Beach, Florida. Loads for 21 water-quality constituents were computed for the runoff from 45 storm events between April 1975 and July 1977. The size of the basin is 58.3 acres and 36 percent impervious. Stormwater runoff from urban watersheds represent an unqualified but possibly major source of contaminants to the numerous canals in south Florida. The quantification of the contaminate load from different land-use areas will assist governmental agencies involved with pollution control in evaluating alternative drainage system designs. (Woodard-USGS)
W79-04407

DATA NEEDS IN URBAN HYDROLOGY,
Geological Survey, Portland, OR. Water Resources Div.
For primary bibliographic entry see Field 7A.
W79-04409

WHO OWNS OUR BEACHES,
For primary bibliographic entry see Field 6E.
W79-04418

DRAWING THE LINE AT THE OCEANFRONT: THE ROLE OF COASTAL CONSTRUCTION SETBACK LINES IN REGULATING DEVELOPMENT OF THE COASTAL ZONE,
Spessard L. Holland Law Center, Gainesville, FL.
For primary bibliographic entry see Field 2J.
W79-04432

NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 5A.
W79-04443

HUELSMANN V. STATE (RECOVERY DENIED FOR LOSS OF WELL WATER CAUSED BY HIGHWAY CONSTRUCTION).
For primary bibliographic entry see Field 2F.
W79-04456

4D. Watershed Protection

RESERVOIR SEDIMENTATION AS A FUNCTION OF PRECIPITATION VARIABILITY,
Maryland Univ., Baltimore. Dept. of Geography.
J. M. Harlin.
Water Resources Bulletin, Vol. 14, No. 6, p 1457-1465, December 1978. 4 fig, 3 tab, 8 ref.

Descriptors: *Sedimentation, *Reservoirs, *Precipitation(Atmospheric), Land use, Precipitation intensity, Reservoir silting, Sediment yield, Linear programming, Runoff, Fluvial sediments, *Precipitation variability, *Reservoir sedimentation, Linear relationships, Coefficient of variation, Annual precipitation, Cost-benefit ratio, Step-wise regression, Multicolinearity.

Sedimentation-precipitation variability was examined as a critical factor in reservoir design. The coefficient of variation for annual precipitation, computed for the period relating to sedimentation, was regressed against sediment yields for several reservoirs over a wide range of environmental settings. A significant linear relationship resulted, and when precipitation variability was combined with several additional variables available from reservoir summary sheets, almost 83% of the total variation in sediment yield was accounted for. It was suggested that the coefficient of variation for annual precipitation fulfilled a direct process role when modeling reservoir sedimentation much more effectively than annual precipitation or runoff. (Roberts-ISWS)
W79-04061

A FINITE ELEMENT HYDROLOGIC MODEL TO DETERMINE THE EFFECT OF LAND MANAGEMENT PRACTICES ON EROSION AND SEDIMENTATION IN A WATERSHED,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
B. B. Ross, V. O. Shanholtz, and D. N. Contractor.
Paper presented at 1978 Water Meeting American Society of Agricultural Engineers, Chicago, Illinois, Dec 18-20, 1978. Paper No. 78-2507, ASAE, St. Joseph, Michigan, 42 p, 11 fig, 7 tab, 41 ref. OWRT A-077-VA(3).

Descriptors: *Finite element model, *Flood flow routing, Land use, Erosion, Sediment transport, Watershed model.

This research proposes the use of a finite element flood routing model for simulating erosion and sediment transport. This computer-based spatially responsive model represents one approach to incorporating spatial heterogeneity and a conceptual framework for tracing non-point sources of pollution. A conceptual framework is provided whereby detailed spatiotemporal variations in such factors as soils, land-use topography, and rainfall can be integrated to predict water quantity and quality. Therefore, the effect of various land-use management practices on erosion and sediment transport can be determined.
W79-04091

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME I: MAIN REPORT.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 542, Price codes: A10 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, OR., December 1971, 141 p, 9 tab, 4 plates, 3 exhibits, attachment.

Descriptors: *Planning, *Water resources development, *Watershed management, *River basin development, *Umpqua River(OR), *South Umpqua River(OR), Oregon, Non-structural alternatives, Multiple-purpose projects, Multi-purpose reservoirs, Geology, Topography, Climate, Hydrology, Flooding, Economics, Natural resources, Environmental effects, Irrigation, Power system operation, Water quality, Navigation, Cost-benefit analysis, Fish management, Construction, Water supply, Anadromous fish, Environmental impacts, Structural alternatives.

This is the Main Report of a 4-volume study and summarizes a plan for the solution of water resource problems in the area drained by the South Umpqua River, one of the Umpqua River's two principal tributaries. The South Umpqua River drainage contains the main center of population and economic development in the Umpqua River Basin, for which the study was authorized. The Basin has problems of both flooding and water shortage. A general description of the watershed is given, including geology and topography, natural resources, and environmental factors. Economic development is reviewed through population, industry and transportation, and utilities. Climate and hydrology are studied; flooding is then assayed. Problems and solutions considered are presented for flooding, irrigation, power generation, water supply, fish and wildlife, recreation, water quality and navigation. Plans are considered and formulated and their environmental impacts reviewed. Costs are estimated, compared with benefits, and methods of allocation and repayment are proposed. Finally, local participation and institutional coordination are discussed. Conclusions are that serious flood and water shortage problems exist and that structural measures must be adopted to solve these problems; the anadromous fish runs are national and international resources, and the federal government should take responsibility for the enhancement of these resources; and that most of the costs borne by implementation of the recommendations are reimbursable by potential users. Recommended is the construction of a multiple-purpose storage project for flood control, irrigation, municipal and industrial water supply, fishery enhancement, recreation, and water quality control. (Zayac-NC)
W79-04139

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME IV, APPENDICES E THROUGH J, REPORTS OF COORDINATING AGENCIES.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6G.
W79-04141

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04143

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N,
Big Muddy River Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04144

SMALL MAMMAL HABITAT IN DIFFERENT-AGED CHAMISE-WEDGELEAF CEANOTHUS CHAPARRAL,
California Univ., Berkeley. Dept. of Forestry and Resources Management.
For primary bibliographic entry see Field 4A.
W79-04259

EFFECTIVENESS OF SEDIMENT-CONTROL TECHNIQUES USED DURING HIGHWAY CONSTRUCTION IN CENTRAL PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
L. A. Reed.
Availability Supt. of Documents, GPO, Washington, DC 20402 Price $2.25. Geological Survey Water-Supply Paper-2054, 1978. 57 p, 36 fig, 11 tab, 10 ref.

Descriptors: *Sediment control, *Watersheds(Basins), *Sediment yield, *Road construction, *Pennsylvania, Ponds, Trap efficiency, Sediment discharge, Sediment transport, Sediment load.

A different method for controlling erosion and sediment transport during highway construction was used in each of three adjacent drainage basins in central Pennsylvania. In one basin three offstream ponds were constructed to intercept runoff from the construction area before it reached the stream. In another a large onstream pond was constructed on the main stream below the construction area. The offstream ponds trapped 60 percent of the sediment that reached there. The onstream pond trapped about 60 percent of the sediment that reached there. The onstream pond trapped about 80 percent of the sediment that reached it; however, it kept the stream turbid for long periods after storms. In the third basin seeding and mulching reduced sediment loads about 20 percent during construction, and small rock dams reduced sediment loads about 5 percent. (Woodard-USGS)

W79-04403

THE LEGAL SIGNIFICANCE OF THE LOCAL GOVERNMENT COMPREHENSIVE PLAN,
For primary bibliographic entry see Field 6E.
W79-04420

EROSION PREDICTION ON CALIFORNIA RANGELAND: RESEARCH DEVELOPMENTS AND NEEDS,
California Univ., Davis. Dept. of Land, Air, and Water Resources.
M. J. Singer, G. L. Huntington, and H. R. Sketchley.
In: Soil Erosion: Prediction and Control, Proceedings of National Conference on Soil Erosion, May 24-26, 1976, Purdue University, West Lafayette, IN. p 143-151. Soil Conservation Society of America, Ankeny, IA. (1976). (California Water Resources Center Project UCAL-WRC-W-502).

Descriptors: *Erosion, *Rangeland, Soil erosion, Erosion rates, Erosion control.

It is imperative that land use planners and land managers know the nature of the soil resource and the effects of changing uses on that resource. Because of the steep rangeland terrain, soil erosion is a potential problem. In fact, two problems exist. First, tolerable soil loss levels are low because of the thin soils and relatively slow rate of soil formation. Second, these soil losses contribute to nonpoint pollution. The universal soil loss equation (USLE) offers an attractive method for predicting the potential erosion losses under known rainfall, soil, topographic, and use conditions. Because of its wide acceptance in agriculture east of the Rocky Mountains and the basic approach taken in developing the factors, it is logical to attempt to use the equation west of the Rocky Mountains for predicting potential erosion losses in California's rangeland. Work has proceeded along three paths: field research using standardized plots, laboratory and field research on mini-plots with a portable rainfall simulator, and computer modeling using field and laboratory data. (Snyder-Calif Davis)
W79-04487

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

VIABILITY MEASUREMENTS ON ACTIVATED SLUDGE,
Alabama Univ. in Birmingham. Dept. of Biology.
For primary bibliographic entry see Field 5D.
W79-04006

EXPERIMENTAL EVALUATION OF CHEMICAL TRANSPORT IN WATER-SATURATED POROUS MEDIA: 2. SORBING MEDIA,
Oregon State Univ., Corvallis. Dept. of Soil Science.
S. K. Saxena, F. T. Lindstrom, and L. Boersma.
Soil Science, Vol 118, No 4, p 238-242, 1974. 1 fig, 1 tab, 6 ref. OWRT B-001-ORE(14) Part 2.

Descriptors: *Path of pollutants, *2,4-D, *Waste water treatment, Pesticides, Leaching, Tracking techniques, Water pollution, Model studies, Equations, Laboratory tests, Evaluation, Porous media, Sorption, Dispersion.

A theoretical dispersion model, previously developed to determine dispersion profiles at different levels of sorption, is evaluated. Dispersion profiles of 2,4-dichlorophenoxyacetic acid in sorbing porous media show the increase in dispersion with increasing pore size. The sorbing characteristics of the porous media produced a distinct tailing along the trailing edge of the moving chemical front. The equation describing the experiments is presented. Experimental results agreed with the theoretical predictions; a set of experiments using glass beads coated with twice as much resin produced similar agreement. (See also W74-12306) (Davison-IPA)
W79-04014

CONTENTS OF SOME HEAVY METALS IN NORWEGIAN RIVERS,
Institutt for Atomenergi, Kjeller (Norway). Isotope Labs.
K. Lenvik, E. Steinnes, and A. C. Pappas.
Nordic Hydrology, Vol. 9, No. 3/4, p 197-206, 1978. 1 fig, 3 tab, 14 ref.

Descriptors: *Heavy metals, *Rivers, *Pollutants, Sampling, Chemical analysis, Water chemistry, Neutron activation analysis, Zinc, Cadmium, Arsenic, Cobalt, Molybdenum, Uranium, Surveys, On-site data collections, Data processing, *Norway, *Norwegian rivers.

Concentration data for the elements arsenic, cadmium, cobalt, molybdenum, zinc, and uranium in 11 Norwegian rivers, determined by neutron activation analysis, were presented. The mean values of the various rivers showed the following range for the elements studied (micrograms/liter): As, less than 0.02-1.05;Cd, less than 0.06-0.43;Co, 0.09-0.46; Mo less than 0.10-1.62;Zn, less than 2-53; U, 0.041-0.58. The weighted mean values in this work were similar to the estimated world averages for rivers in the case of Co and Zn. For As, Mo, and U, the present values were lower than the world averages by a factor of 3 or more. This may be due to lower abundance of sedimentary rocks and deposits in Norway compared with the drainage basins of some of the major rivers in the world. (Sims-ISWS)
W79-04021

AN ASSESSMENT OF WATER QUALITY IN THE SPOON RIVER, PART 2,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions, Illinois State Academy of Science, Vol. 70, No. 3/4, p 272-285, September-December 1977. 14 fig, 3 tab, 9 ref.

Descriptors: *Water quality, *Rivers, *Illinois, *Sampling, Streamflow, Chemicals, Water chemistry, Calcium, Magnesium, Sulfates, Manganese, Iron, Silica, Phosphorus, Phosphates, Pollutants, Water pollution, Data processing, Analytical techniques, *Spoon River(IL).

The spatial and temporal variations of calcium, magnesium, manganese, iron, silica, sulfate, and phosphorus at 5 locations on the Spoon River were reported. Stream gaging data at the sampling sites and synthesized flow data, where flow measurements were lacking, were used to calculate the nutrient loads transported by the river. Results of the 2-year study showed: (1) the spatial distribution of calcium and magnesium differs very little along the river; (2) sulfate concentrations tend to increase in the downstream direction; (3) total iron concentrations exceed the Illinois Pollution Control Board limit of 1 mg/l 90% of the time; (4) concentrations of silica range from 9.36 mg/l at Modena to 7 mg/l at Havana; and (5) phosphorus concentrations exceed the state standards 100% of the time at Modena and about 90% of the time at London Mills, Seville, and Havana. (Sims-ISWS)
W79-04047

AN ASSESSMENT OF WATER QUALITY IN THE SPOON RIVER, PART 1,
Illinois State Water Survey, Peoria. Water Quality Section.
V. Kothandaraman, and R. L. Evans.
Transactions, Illinois State Academy of Science, Vol. 70, No. 3/4, p 253-271, September-December 1977. 20 fig, 3 tab, 8 ref.

Descriptors: *Water quality, *Rivers, *Illinois, *Sampling, Temperature, Water temperature, Dissolved oxygen, Turbidity, Hydrogen ion concentration, Alkalinity, Hardness(Water), Nitrates, Ammonia, Nitrogen, Chemical oxygen demand, Suspended solids, Dissolved solids, Chemicals, Data processing, Analytical techniques, Pollutants, Water pollution, *Spoon River(IL).

The physical and chemical water quality characteristics of the Spoon River, covering a period of 2 years from June 1971 through May 1973, were presented in this report. The river water temperature exhibited distinct annual cyclic fluctuations. The dissolved oxygen concentration showed a remarkable degree of inverse relationship to water temperatures. The nitrate concentrations in the Spoon River were the highest at Modena and decreased progressively downstream. The nitrate-nitrogen concentrations in the Spoon River at Havana and Seville met the Illinois Pollution Control Board standard of 10 mg/l as nitrogen at all times, whereas the limit was exceeded at the other 3 sampling locations about 5% of the time. The nitrate-nitrogen contribution to the river from the watershed ranged from 16.5 lbs/ac/yr at Modena to 10 lbs/ac/yr at Havana. (Sims-ISWS)
W79-04048

PROJECTING URBAN RUNOFF FLOWS AND LOADS,
Basic Technology, Inc., Pittsburgh, PA.
For primary bibliographic entry see Field 5B.
W79-04050

ASSESSING NONPOINT WATER QUALITY FOR SMALL STREAMS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04051

STORMWATER ANALYSIS AND PREDICTION IN HOUSTON,
Rice Univ., Houston. TX. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5B.
W79-04052

JUNE 1976 POLLUTION OF LONG ISLAND OCEAN BEACHES,
State Univ. of New York at Stony Brook.
For primary bibliographic entry see Field 5B.
W79-04053

AMMONIA IN TEXAS STREAMS DURING LOW FLOW FROM MUNICIPAL WASTEWATER,
Texas Univ. Health Science Center at Houston. School of Public Health.
For primary bibliographic entry see Field 5B.
W79-04063

A MODEL OF THE BEHAVIOR OF PH DETERMINING PARAMETERS IN IMPOUNDMENTS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W79-04064

RADIUM-226 IN GROUND WATER OF WEST CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
For primary bibliographic entry see Field 5B.
W79-04065

WELLS AND PONDS: WATER QUALITY AND SUPPLY,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W79-04068

HYDROLOGIC PARAMETERS FROM LANDSAT IMAGERY FOR WILLIAMS FORK WATERSHED,
Colorado State Univ., Fort Collins. Civil Engr.

Dept.
Jose Elvecio Pernia.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 083, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis, Spring 1978. 124 p, 16 fig, 15 tab, 46 ref. OWRT B-160-COLO(1).

Descriptors: *LANDSAT, *Watersheds, Snowcover, Runoff, *Geomorphology, Satellites, Williams Fork Watershed(Colo).

The possibility of using LANDSAT satellite data to obtain information useful in the hydrologic analysis of mountainous watersheds was explored. Mapping the major cover types of the Williams Fork Watershed, extracting physiographic parameters of the basin, and temporal mapping of snowcover were the main objectives. In classifying the major types, the modified unsupervised (clustering) approach was applied to the LANDSAT MSS digital data. 20 classes representing 17 major informational cover types present in the Williams Fork Watershed were defined. The variable probability sampling method was used in the random selection of sample units to check the computer-aided classification performance. Color infrared aerial photography at 1:24,000 and 1:62,000 scales provided the required ground truth. Average weighted errors ranging from 7% to 12.2% were found. A test area of approximately 8% of the watershed area was selected to evaluate the computer classification of the tundra cover types. The differences between the results from the computer maps and the interpretation of the aerial photography ranged from 3.3% to 10.4%. An average weighted root mean square deviation of 12.1% was found. Visual interpretation of LANDSAT MSS transparencies provided approximate information about location and extension of only four broad land cover categories (forest, non-forest, tundra, and water). Physiographic parameters including watershed area, perimeter, basin shape, basin axial length, length of main stream, total stream length, drainage density and drainage pattern were derived from the LANDSAT MSS transparencies. Temporal snowcover mapping of the Williams Fork Watershed was performed for 1975 and 1976, using a Zoom Transfer Scope, on the LANDSAT transparencies, for USS band 5.
W79-04073

MICROBIAL GROWTH ON HYDROCARBONS – SOME EXPERIMENTAL RESULTS,
Rhode Island Univ., Kingston. Dept. of Chemical Engineering.
S. K. Velankar, S. M. Barnett, C. W. Houston, and A. R. Thompson.
Biotechnology and Bioengineering, Vol. 17, p 241-251, 1975. 6 fig, 13 ref.

Descriptors: *Microorganisms, *Pseudomonas aeruginosa, *Growth rates, Laboratory tests, Model studies, Microbiology, Surface tension, Analytical techniques, Biochemistry, Carbon.

Experimental results supporting a proposed model for the transport of hydrocarbon in a fermentation system are reported. This model considers that the presence of micelles of surface active agents are essential to the growth of microbial cells on hydrocarbon substrates. Pseudomonas aeruginosa was grown on a heptane substrate in a shake flask. Growth was monitored by optical density; microscopic examination determined that optical density measurements were reproducible. The work of other researchers is interpreted using this model. Further research is recommended. (Davison-IPA)
W79-04101

DEVELOPMENT AND ASSESSMENT OF ACUTE BIOASSAY TECHNIQUES FOR THE LITTORAL ROTIFER, PHILODINA ACUTICORNIS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
A. L. Buikema, Jr., J. Cairns, Jr., and G. W. Sullivan.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 937, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University. Completion Report (1973), 35 p, 18 fig, 3 tab. OWRT-A-047-VA(1).

Descriptors: *Bioassay, *Rotifers, Heavy metals, Cadmium, Copper, Cobalt, Mercury, Lead, Nickel, Chromium, Silver, Zinc, Ammonium, Salt, Phenols, Toxicity, Philodina acuticornis.

Techniques were examined for using Philodina as a bioassay organism. The toxicity of 12 heavy metals, ammonium chloride and phenol to Philodina were studied. In soft water the order of toxicity (most to least) was: cadmium, mercury and copper, zinc, silver, nickel (chloride), chromium, nickel (sulfate), lead, cobalt, ammonium chloride and phenol. In hard water the order was cadmium, mercury, zinc, copper, chromium and lead. The chloride salts of cadmium and zinc were less toxic than sulfate salts. Nickelous sulfate was less toxic than the chloride salt. The toxicity of zinc decreases as water hardness and alkalinity increases. Calcium is the principal zinc antagonist at hardnesses less than 90 ppm, magnesium is at hardnesses greater than 90 ppm. Toxicity of zinc is less at 10 C but there were no differences between 20 and 30 C. Rotifer eggs are resistant to zinc concentrations that cause 100% mortality of adults. Young are more sensitive than adults. There was no apparent effect of population size on toxicity. The probit analysis, commonly used in bioassay research, may not be a satisfactory statistical analysis when studying populations of organisms of various age or size structure.
W79-04120

LET'S UPGRADE THE BOD TEST,
Arthur Bros. Co., Inc., Fond du Lac, WI.
R. M. Arthur.
Water and Sewage Works, Vol. 121, No. 6, p 100-102, June, 1974. 2 fig, 11 ref.

Descriptors: *Biochemical oxygen demand, *Analytical techniques, Laboratory equipment, Standards, Instrumentation, Water pollution, Biochemistry, Water analysis, *Manometric method of BOD.

The manometric method of performing the BOD test as contrasted to the dilution method is discussed. A new method of determining BOD using modern instrumentation is recommended and explained. The new method has the following advantages: it is a biochemical test; the simplest of manipulative skills are required; it requires a low capital investment for equipment and less daily labor costs; it is similar to the dilution techniques and can be accepted as a Standard test; and large undiluted samples are used. In addition, it simultaneously measures rate as well as total oxygen demand: shorter time is needed to provide information about the strength of a waste; and the results are more accurate than the dilution method. (Orr-FIRL)
W79-04277

TOXICITY OF CUPRIC ION TO EGGS OF THE SPOT LEIOSTOMUS XANTHURUS AND THE ATLANTIC SILVERSIDE MENIDIA MENIDIA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 5C.
W79-04314

THE EFFECT OF PETROCHEMICAL STRUCTURE ON METHANE FERMENTATION TOXICITY,
Drexel Univ., PA. Environmental Studies Inst.
W. L. Chou, R. E. Speece, R. H. Siddiqi, and K. McKeon.
Progress in Water Technology, Vol. 10, No. 5-6, p 545-558, 1978. 21 fig, 4 tab, 17 ref.

Descriptors: *Waste water treatment, *Chemical wastes, *Microbial degradation, *Fermentation, *Methane bacteria, Chemical reactions, Chemical analysis, Toxicity, Bacteria, Heavy metals, Anaerobic bacteria, Chemical properties, Organic compounds, Methane, Alcohols, Acids, *Petrochemicals.

Wastewaters from petrochemical plants are commonly treated by energy intensive aerobic processes. Anaerobic digestion of such wastes would not only result in saving energy, but would also produce methane gas which could be utilized as fuel. Further, the process requires a lower input of inorganic nutrients as compared to aerobic treatment and can be used with wastes containing toxic heavy metals. It also produces a lower quantity of excess sludge. This study was designed to evaluate the effect of molecular structure on toxicity to methane fermentation. Fifty-two petrochemicals were assayed. Toxicity to unacclimated methane cultures developed on acetate substrate was assayed. The results showed definite correlations of molecular structure and toxicity. Chloro substitution, aldehydes, double bonds and benzene rings exhibited toxicity to unacclimated cultures. The addition of hydroxyl groups and increased carbon chain length decreased the above toxicities. Acclimation to a toxic compound substantially reduced its toxicity in the case of aldehydes, double bonds and benzene rings. (Deal-EIS)
W79-04315

ACUTE TOXICITY OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL TO THE MANILA CLAM,
California Univ., Bodega Bay. Bodega Marine Lab.
For primary bibliographic entry see Field 5C.
W79-04323

THE PETROLEUM-INDUCIBLE MIXED-FUNCTION OXIDASE OF CUNNER (TAUTOGOLABRUS ADSPERSUS WALBAUM 1792): SOME CHARACTERISTICS RELEVANT TO HYDROCARBON MONITORING,
Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
D. G. Walton, W. R. Penrose, and J. M. Green.
Journal of the Fisheries Research Board of Canada, Vol. 35, p 1547-1552, 1978. 3 fig, 54 tab, 22 ref.

Descriptors: *Enzymes, *Oil pollution, *Fish physiology, Oil, Animal metabolism, Organic compounds, Biochemistry, Proteins, Oil spills, Mussels, Fish reproduction, Spawning, Chemical reactions, *Cunner, *Tautogolabrus, *Crude oil.

The hepatic aryl hydrocarbon hydroxylase of the cunner is a sensitive indicator of petroleum contamination. This fish is a particularly favorable species because of its limited home range and ease of capture. Oil concentrations of 1-2 mg/L in water caused two-to sixfold induction of the enzyme above uninduced levels; induction decayed in <7 d after exposure ceased. Feeding of crude oil or mussel tissue contaminated with oil at a concentration of 500 mg/kg caused up to fivefold induction. Males maintained a constant specific activity of aryl hydroxylase through the season, but females had a decreased activity before spawning. Starvation may also have reduced AHH activity. Correlations with liver and body weight were not observed. 2,5-Diphenyloxazole was found to be a safe substitute for benzo(a)pyrene in the assay. (Deal-EIS)
W79-04324

SWIMMING SPEEDS OF OYSTER LARVAE CRASSOSTREA VIRGINICA IN DIFFERENT SALINITIES AND TEMPERATURES,
New Jersey Oyster Research Lab., New Brunswick.
H. Hidu, and H. H. Haskin.
Estuaries, Vol. 1, No. 4, p 252-255, 1978. 3 fig, 12 ref.

Descriptors: *Oysters, *Salinity, *Water temperature, *Animal behavior, Larval growth stage, Growth stages, Toxicity, Animal physiology, Swimming, Water Chemistry, Estuaries, Tidal effects, *Formalin, *Geotaxis, *Phototaxis.

Swimming speeds of oyster larvae were determined in constant and increasing salinities to learn more about the oyster larval 'salinity response.' 'Normal' non-directed swimming speeds ranged from less than 1 cm/min for early veligers to 5 cu/min for 'eyed' veligers with temperature an important variable. When subjected to hourly salinity increases of 0.5%, most larvae swam upward or downward at approximately 3 times the above speeds. Larvae with valves closed in response to traces of formalin sank at speeds of 5 to 50 cm/min depending on larval stage. The results may explain the differential vertical position of larval stages in estuaries and suggest the presence of a taxic component to the salinity response. (Deal-EIS)
W79-04325

SPECTROPHOTOMETRICALY ASSAYED INHIBITORY EFFECTS OF MERCURIC COMPOUNDS ON ANABAENA FLOS-AQUAE AND ANACYSTIS NIDULANS (CYANOPHYCEAE),
New Orleans Univ., LA. Dept. of Biological Sciences.
D. J. Thomas, and J. G. Montes.
Journal of Phycology, Vol. 14, p 494-499. 1978. 1 tab, 23 ref.

Descriptors: Metals, *Mercury, Water pollution effects, *Algae, Mercuric chloride, Methylmercuric chloride, Phenylmercuric acetate, Bioassay, Laboratory tests, Phytoplankton, *Blue green algae, *Inhibition, Spectrophotometry, Inhibitory effects, Growth rates, Anabaena, Anacystis.

The growth-related inhibitory effects of mercuric chloride (MC), methylmercuric chloride (MMC) and phenylmercuric acetate (PMA) (each at 1, 10, 10 to the 2nd power, 10 to the 3rd power ppb) were measured in Anabaena and Anacystis. Optical density changes of control cultures compared against those of experimental cultures showed than MC was the least inhibitory of the compounds. MMC was the most inhibitory, producing statistically significant inhibition at a concentration as low as 1 ppb in Anabaena. PMA was more inhibitory than MC but less than MMC. Effects caused by the mercury compounds included bleaching of individual cells, cell size changes and destruction of whole cells; the degree and extent of these effects depended on the compound and its concentration in the nutrient medium. The high sensitivities of the algae tested suggested the possibility of using them as test organisms in bioassays for mercury. (Katz-EIS)
W79-04327

FURTHER STUDIES ON BIFIDOBACTERIA AS INDICATORS OF FAECAL POLLUTION IN WATER,
Newcastle-upon-Tyne Univ. (Great Britain). Dept. of Civil Engineering.
L. M. Evison, and S. Morgan.
Progress in Water Technology, Vol. 10, No. 5-6, p 341-350, 1978. 3 fig, 4 tab, 10 ref.

Descriptors: *Pathogenic bacteria, *E. coli, *Enteric bacteria, Cytological studies, Epidemiology, Coliforms, Sewage bacteria, *Bioindicators, Chemical analysis, Biochemistry, Cultures, Farm wastes, Domestic wastes, *Bifidobacteria.

Additional data on the distribution, identification and growth reactions of the bifidobacterium group of bacteria support preliminary reports that the organisms are more numerous than E. coli, and are widely distributed in all human faecal specimens. Growth responses of typed cultures of bifidobacteria indicate that the organisms are very unlikely to regrow in the extra-enteral environment. It seems that further research into the use of this group of organisms as an indicator of faecal pollution of water is justified. (Deal-EIS)
W79-04328

RELATIONSHIP BETWEEN INDICATOR ORGANISMS AND SELECTED PATHOGENIC BACTERIA IN URBAN WATERWAYS,
Johns Hopkins Univ., Baltimore, MD Environmental Health.
V. P. Olivieri, K. Kawata, and C. W. Kruse.
Progress in Water Technology, Vol. 10, No. 5-6, p 361-379, 1978. 5 fig, 5 tab, 6 ref.

Descriptors: *Pathogenic bacteria, *Bioindicators, *Urban runoff, Pseudomonas, Salmonella, Water quality, Coliforms, Bacteria, Storm runoff, Streams, Sewage bacteria, Sewage, Urban drainage, Storm water, *Staphylococcus.

Samples were collected from sewage, urban streams, and stormwater runoff over a thirteen month period and assayed for the levels of total coliform, fecal coliform, fecal streptococci, Salmonella sp., Pseudomonas aeruginosa and Staphylococcus courses. P. aeruginosa was the most numerous, S. aureus was found at low levels, and Salmonella required concentration for enumeration. Positive correlations between the levels of indicator and pathogenic bacteria were observed when all the samples and the routine examined background samples from sewage, urban streams, and raw water reservoir were considered. (Katz-EIS)
W79-04330

IN VIVO EFFECT OF ENDRIN ON THREE PHOSPHATASES IN KIDNEY AND LIVER OF THE FISH OPHIOCEPHALUS PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04333

LEVELS OF BLOOD GLUCOSE AND TISSUE GLYCOGEN IN TWO LIVE FISH EXPOSED TO INDUSTRIAL EFFLUENT,
Centra Fisheries Extension Training Center, Hyderbad (India).
A. D. Diwan, H. G. Hingorani, and N. C. Naidu.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 269-272, 1979. 2 tab, 12 ref.

Descriptors: *Chemical wastes, *Toxicity, *Fish physiology, Industrial wastes, Sewage effluents, Chemical properties, Chemical analysis, Animal metabolism, Mortality, Proteins, Carbohydrates, *Tissue analysis, *Heteropneustes, *Clarias, Blood glucose levels.

Fish were exposed to complex chemical wastes from an industrial area near Hyderbad, India. First, LC50 values were determined for both species of fish tested (Heteropneustes fossilis and Clarias batrachus). Next, 6 fish of each species were exposed to 50% of the LC50 for 15 days. The fish were then sacrificed and tissue glycogen and blood glucose levels determined. There was 92.2% and 95.3% increase in blood glucose level of H. fossilis and C. batrachus, respectively, after exposure to effluents. In C. batrachus a significant decrease in glycogen level was found in liver, muscles and gills, whereas in heart and kidney there was a slight increase. A significant decrease in glycogen level in H. fossilis was observed only in liver and gills. In muscles of H. fossilis there was a 13.2% decrease in glycogen level which is not significant. (Deal-EIS)
W79-04338

ARSENIC ACCUMULATION, TISSUE DISTRIBUTION AND CYTO-TOXICITY IN TELEOSTS FOLLOWING INDIRECT AQUEOUS EXPOSURES,
Texas Univ. at Austin. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04344

ALTERATION IN THE ACTIVITIES OF THREE PEPTIDASES AND LIPASE IN THE DIGESTIVE SYSTEM OF THE FISH CHANNA PUNCTATUS EXPOSED TO LEAD NITRATE,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W79-04345

RAPID METHOD FOR DETERMINING NUMBERS OF SEWAGE POLLUTION BACTERIA (E.G., COLIFORMS) IN WATER,
Vanderbilt Univ., Nashville, TN. School of Engineering.
G. W. Malaney, and R. D. Tanner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 244, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Center, University of Tennessee, Knoxville, Research Report No. 66, December 1978. OWRT A-050-TENN(1), 14-34-0001-8045.

Descriptors: *Sewage bacteria, *Coliforms, Culture media, Impedance method.

A 6-8 hour method for estimating the density of total coliform bacteria in water based on change in impedance in diagnostic culture media was developed. The change is brought about by the growth and/or biochemical activity of the coliforms. The diagnostic culture media combination was m-Endo Broth as enrichment, followed by BGLB Broth. The estimation technique was based on the cut-off time method of Hardy, Kraeger, Dufour and Cady (Appl. Environ. Microbiol., 34, 14. 1977). Cut-off time was defined as the incubation time required to produce a change of + or - 0.010 in impedence ratio. Cut-off time was correlated with coliform density by running a total coliform count on the same water sample by Standard Methods Membrane Filter Method.
W79-04389

WYOMING'S SPECKLED DACE,
Geological Survey, Cheyenne, WY. Water Resources Div.
M. J. Engelke, Jr.
Wyoming Wildlife, Vol. XLIII, No. 1, p 24, January 1979.

Descriptors: *Water quality, *Fish, *Wyoming, *Perennial streams, *Intermittent streams, Lakes, Ponds, Springs, Forage fish, Aquatic habitats, *Speckled dace, *Water quality indicator, Green River basin, Southwestern Wyoming.

The speckled dace, a nongame fish species, is a resident in intermittent and perennial streams in the prairies of southwestern Wyoming where energy resources may be developed. The speckled dace is the only species in many waters in southwestern Wyoming and may be an important indicator of adverse impacts in these waters. An unrecorded spawning method of the speckled dace has been observed and is described. (Woodard-USGS)
W79-04408

MARINE RECEIVING WATER MONITORING PROGRAM FOR PULP MILL EFFLUENT (OF CANADIAN CELLULOSE CO. LTD.) AT PRINCE RUPERT,
Canadian Cellulose Co. Ltd., Prince Rupert (British Columbia).
D. S. N. Ho.
In: Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jaspar, Alberta, Preprinted Proceedings, p 92-97. 10 fig, 10 ref, 2 tab.

Descriptors: *Pulp wastes, *Water pollution effect, *Monitoring, Water analysis, Wastes, Industrial wastes, Water pollution sources, Canada, Foreign countries, Pulp and paper industry, Effluents, Biological properties, Hydrography, Benthic fauna, Benthic flora, Water temperature, Salinity, Turbidity, Hydrogen ion concentration, Lignins, Color, Dissolved oxygen, Surface waters, Tannin, Kraft mills, Organic matter.

Canadian Cellulose Co. Ltd., Northern Pulp Operations (Prince Rupert, British Columbia), has successfully established a continual biological (benthic analysis) and hydrographic (temperature, salinity, turbidity, pH, tannin and lignin concentration, color, and dissolved oxygen) monitoring program on its receiving waters. The program has yielded good background information and also provided

valuable data to assess the environmental impact of the kraft mill effluents. (Swichtenberg-IPC)
W79-04416

SECTION 404 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977: HYDROLOGIC MODIFICATION, WETLANDS PROTECTION AND THE PHYSICAL INTEGRITY OF THE NATION'S WATERS,
E. Thompson, Jr.
The Harvard Environmental Law Review, Vol. 2, p. 264-287, 1977.

Descriptors: *Federal water pollution control act, *Wetlands, *Water quality, *Hydrologic systems, Dredging, Drainage, Regulation, Discharge(Water), Legislation, Streams, Resource development, Environmental effects.

The objective of the Federal Water Pollution Control Act (FWPCA) is to restore and maintain the chemical, physical and biological integrity of the nation's wates. A serious but relatively underpublicized threat to the quality of streams and watersheds is hydrologic modification--the conversion of wetlands to dry ground through dredging and filling. Unlike chemical pollution, which tends to reverse itself when ceased, hydrologic modification results in the permanent alteration of the natural capacity of a water body to cleanse itself of pollution and to support a healthy biological system. It has been estimated that almost half of the wetlands which once existed in the United States have been destroyed by dredging, filling and drainage. Two FWPA provisions address the problem of hydrologic modification. Section 208 provides for a program of state planning and regulation of water pollution. Section 404 authorized the U.S. Army Corps of Engineers, in conjunction with the federal Environmental Protection Agency, to regulate discharges of dredged and fill materials. This article traces the history of federal regulation of hydrologic modification and examines the implications of recent amendments to the FWPCA. (Hucks-Florida)
W79-04419

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

NONPOINT SOURCE POLLUTION,
R. J. Lazarus.
The Harvard Environmental Law Review, Vol. 2, p 176-98, 1977.

Descriptors: *Water pollution sources, *Federal water pollution control act, Pollution abatement, *Water quality control, Water pollution, Pollutants, Sediment control, Regulation, Land use, Waste treatment, Resource management, Standards.

Traditionally, the focus of federal and state pollution control efforts have been on point source pollution. Recently, however, greater emphasis has been placed on nonpoint source pollution. Nonpoint source is a term applied to water pollution which does not emanate from any 'discernible, confined and discrete conveyance.' The principal pollutant from non-point sources is sediment from erosion caused by agricultural activities. Industry, mining operations and construction are also major causes of nonpoint source pollution. The Federal Water Pollution Control Act (FWPCA) is the federal government's major weapon against water pollution. The FWPCA's 1977 amendments reflect the growing concern over nonpoint source pollution, which according to several studies, may often be responsible for a greater percentage of pollution than are point sources. This article discusses the history of nonpoint source control under the FWPCA, significant developments in nonpoint source control which occurred during 1977 and provides a brief assessment of the prospects for achieving needed nonpoint source pollution abatement in light of these developments. In addition to federal efforts in this area, recent developments in state pollution control are examined. (Hucks-Florida)
W79-04443

ENDOTOXIN IN WATERS OF THE STATE OF VERMONT,
Vermont Univ., Burlington. Dept. of Medical Microbiology.
W. R. Stinebring.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 283, Price codes: A03 in paper copy, A01 in microfiche. Vermont Water Resources Research Center, University of Vermont, 1978. 25 p, 5 tab, 31 ref, append. OWRT A-038-VT(1), 14-34-001-8048.

Descriptors: *Toxins, Endotoxin, Vermont, *Assay, Natural watercourses, Streams.

The micro-limulus assay used in this study is about 1/10th as costly as the standard limulus assay for determination of the endo-toxin content of certain waters of the State of Vermont. These waters varied from pristine streams high in the mountains where there is little opportunity for pollution from animal or human wastes, to rivers which serve as a major receiving waters for many of the villages and towns and cities of the State of Vermont. Findings indicate that in pristine waters there are undetectable levels of endotoxin and other waters range from barely detectable levels, i.e., 0.1 of a microgram/liter to 1000 micrograms/liter, about 5-10 LD50s for the mouse or about 10,000 pyrogenic doses for the average human. Endotoxins which are bacterial products are known to produce absortions, produce fevers, injure tumors, stimulate the production of interferon, and cause death if administered in large enough quantities, in experimental animals into which the endotoxin has been properly administered. It is concluded that there is evidence that this potent biological toxin can be found in significant quantities in certain waters of the State of Vermont.
W79-04492

5B. Sources Of Pollution

THE COMPLEXING AND ADSORPTION OF CADMIUM IN SOILS IN THE PRESENCE OF EDTA AND NTA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
R. Fugii.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 809, Price codes: A07 in paper copy, A01 in microfiche. MS Thesis in Water Science, (1978). 112 p. 10 fig, 7 tab, 3 append. (California Water Resources Center Project UCAL-WRC-W-511). OWRT B-180-CAL(1).

Descriptors: *Cadmium, *Adsorption, *Soils, *Soil treatment, *Heavy metals, Cations, Waste disposal, Soil water, Chemistry, Soil contamination, Water pollution sources, Sewage sludge, Industrial wastes, Effluents, *Path of pollutants.

Varying solution concentrations of cadmium containing EDTA and/or NTA were applied to a Yolo silt loam at a 1:4 soil to solution ratio. The additions of chelating agents decreased significantly the total Cd adsorbed by the soil, EDTA playing a more dominant role than NTA. The Langmuir adsorption equation alone and another model coupling Langmuir adsorption and Gapon exchange adsorption describe well the adsorption of Cd on soil as influenced by 1.5 mg/l EDTA and 1.5 mg/l NTA additions at all but the highest applied Cd concentration used in the experiments. The total adsoprtion isotherm was 'S' shaped. A marked increase in total Cd adsorption occurred at the highest applied Cd concentration. At this applied concentration, the Cd(+2) concentration became significant and this species could participate in cation exchange. Thus, the extent of adsorption depends on the speciation of Cd in solution. A computer program was used to calculate the activities of the free ions and their complexes in the equilibrium solutions. In all solutions free Cd(+2) activities were insignificant. The Cd speciation was dominated by CdEDTA(-2) or CdNTA(-) (in solutions containing no EDTA additions). The concentrations of Ca and Mg complexes of NTA and EDTA were also significant.
W79-04007

TRACE ELEMENTS IN RUNOFF FROM RAINFALL AND SNOWMELT AT SEVERAL LOCALITIES IN THE DENVER, COLORADO, METROPOLITAN AREA,
Geological Survey, Denver, CO. Water Resources Div.
W. M. Alley, and S. R. Ellis.
In: Proceedings of the International Symposium on Urban Storm Water Management, University of Kentucky, Lexington, July 24-27, 1978, p 193-198, 1978. 3 fig, 8 tab, 17 ref.

Descriptors: *Water quality, *Trace elements, *Runoff, Rainfall, Snowmelt, Urban runoff, Chemical analysis, Cadmium, Chromium, Manganese, Mercury, Nickel, Copper, Iron, Lead, Zinc, Colorado, *Denver, Antimony, Lithium, Selenium, Arsenic.

Concentrations of antimony, cadmium, chromium, lithium, manganese, mercury, nickel, and selenium have been determined in selected samples of rainfall runoff from several urban localities in the Denver metropolitan area. Multiple samples collected during periods of runoff from both rainfall and snowmelt were analyzed for arsenic, copper, iron, lead, and zinc. Of these trace elements, iron, lead, and zinc were predominant in runoff from the rainfall and snowmelt, with concentrations of iron at times exceeding 10,000 micrograms per liter and with concentrations of lead and zinc at times exceeding 1,000 micrograms per liter. The concentrations of trace elements were highest during the initial parts of the periods of rainfall runoff and then decreased with time. Trace-element concentrations in snowmelt runoff generally peaked during the middle of the day, corresponding with periods of maximum melting and runoff. Instantaneous loads of trace elements were largely a function of discharge for runoff from both rainfall and snowmelt. The trace elements were predominantly in the particulate phase, with the ratio of particulate to dissolved concentrations averaging 20. Between April 1 and October 31, 1976, estimated total loads of trace elements for a 606-acre residential site were: Arsenic, 0.8 pound; copper, 4.4 pounds; lead, 44 pounds; and zinc, 23 pounds. (Woodard-USGS)
W79-04019

CONVECTIVE CONTAMINANT TRANSPORT TO PUMPING WELL,
Geological Survey, Syosset, NY. Water Resources Div.
T. E. Reilly.
Journal of the Hydraulic Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. HY12, Paper 14258, p 1565-1575, December 1978. 5 fig, 9 ref, 2 append.

Descriptors: *Path of pollutants, *Groundwater movement, *Water table, *Aquifer characteristics, *Pumping, Water wells, Drawdown, Flow rates, Finite element analysis, Flow nets, Analytical techniques, Equations, *Time of travel, *Pollutants, Dimensional analysis.

Traveltime of a contaminant from the water table to a well screen, and its concentration at the well screen at given time intervals, can be determined through a radially symmetric, idealized flow system. Dimensionless flow nets that describe the plug flow of the contaminant are developed through analysis of the two-dimensional radial continuity equation in conjunction with a finite-element simulation of the potential distribution. Results of the study are dimensionless type curves that can be used to calculate traveltimes and concentrations of the contaminant under a multitude of conditions. (Woodard-USGS)
W79-04022

Group 5B—Sources Of Pollution

HYDROGEOLOGY RELATED TO GEOTHERMAL CONDITIONS OF THE FLORIDAN PLATEAU,
Geological Survey, Woods Hole, MA. Water Resources Div., Alabama Univ., Tuscaloosa; and Coastal Petroleum Co., Tallahassee, FL.
For primary bibliographic entry see Field 2F.
W79-04033

QUALITY AND MOVEMENT OF GROUND WATER IN OTTER CREEK - DRY CREEK BASIN, CORTLAND COUNTY, NEW YORK,
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 2A.
W79-04035

MIXING IN SHALLOW COASTAL SEA: CASE STUDY,
New Jesey Dept. of Environmental Protection, Trenton. Delaware River Water Quality Planning.
S. F. Hsueh, and R. C. Ahlert.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14210, p 1293-1304, December 1978. 8 fig, 6 ref, 1 append.

Descriptors: *Estuaries, *Mixing, *Model studies, *On-site investigations, *New Jersey, Dye releases, Tracers, Tides, Tidal waters, Tidal effects, Tidal energy, Dispersion, Hydrodynamics, Water pollution, Pollutants, Path of pollutants, Coasts, Rivers, Data collections, Data processing, *Shrewsbury River(NJ).

Two tracer studies were used to characterize mixing and tidal exchange in a New Jersey coastal sea. Several dredged channels and complex flow patterns due to islands and embayments cause the system to exchange slowly and to be mixed relatively well internally. Tracer output at the mouth displayed multiple peaks, a long delay, and detectable concentrations for several days. A transient, lumped-parameter, reacter network model was calibrated with the second data set. Agreement between the model and field data was good. The simulation did not perform well with the first data set. Further, the output was relatively insensitive to input. This model is not well suited to water quality planning and management for the estuary studied. (Sims-ISWS)
W79-04049

PROJECTING URBAN RUNOFF FLOWS AND LOADS,
Basic Technology, Inc., Pittsburgh, PA.
L. Hajas, D. B. Boggs, A. J. Shuckrow, and R. G. Quimpo.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14243, p 1149-1163, December 1978. 4 fig, 3 tab, 2 ref, 1 append.

Descriptors: *Urban runoff, *Pollutants, *Water quality, *Model studies, *Pennsylvania, Mathematical models, On-site investigations, Sampling, Surveys, Monitoring, Urbanization, Cities, Rainfall, Runoff, Water pollution, Water pollution sources, Storm water, Sewers, Combined sewers, Separated sewers, Planning, Forecasting.

As part of the COWAMP/208 Areawide Water Quality Management Program for the nine-county region that constitutes Southwestern Pennsylvania, an extensive analysis of the magnitude of the urban runoff problem in the study area was carried out. As the predictive tool for estimation of runoff quantity and quality, the Army Corps of Engineers' Storage Treatment Overflow Runoff Model (STORM) was employed. In order to calibrate the model to reflect local characteristics, a field sampling program was performed in several tests basins in the study area. This paper described the design, conduct, methodology, and results of the field program as well as the use of this information in urban runoff flow and load projections. (Sims-ISWS)
W79-04050

ASSESSING NONPOINT WATER QUALITY FOR SMALL STREAMS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
M. E. Meadows, D. W. Weeter, and J. M. Green.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14232, p 1119-1133, December 1978. 6 fig, 8 tab, 21 ref, 2 append.

Descriptors: *Assessments, *Water quality, *Streams, Sampling, Surveys, Monitoring, Water pollution, Water pollution sources, Pollutants, Path of pollutants, Model studies, Mathematical models, Land use, Streamflow, Water resources, Nonpoint water pollution.

The procedures and results of an assessment study of water quality in a small stream impacted only by nonpoint source pollution were presented. Also, considerations for the design of a small stream monitoring survey were discussed. A mathematical model for water quality in small streams was applied to the monitoring data, and estimates of the nonpoint source water quality were obtained. An attempt was made to interpret the nonpoint quality in terms of land use. (Sims-ISWS)
W79-04051

STORMWATER ANALYSIS AND PREDICTION IN HOUSTON,
Rice Univ., Houston. TX. Dept. of Environmental Science and Engineering.
P. G. Bedient, D. A. Harned, and W. G. Characklis.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14237, p 1087-1100, December 1978. 3 fig, 4 tab, 16 ref, 2 append. EPA 802433.

Descriptors: *Storm water, *Water quality, *Water pollution sources, *Texas, Surveys, Sampling, On-site investigations, Model studies, Mathematical models, Storms, Rainfall, Runoff, Streamflow, Water pollution, Pollutants, Path of pollutants, Urbanization, Urban runoff, Data processing, Simulation analysis, *Houston(TX).

Analyses of available stormwater hydrologic and water quality data for several Houston area watersheds yielded direct linear relationships between pollutant mass loading rates and cumulative storm runoff volume. These relationships then were used to rank the watersheds on a pollutant load per unit runoff basis and to calculate total annual pollutant loads for each area. Further, a plot of dimensionless cumulative flow versus the dimensionless cumulative flux provides a quantifiable means to evaluate the first flush, allowing comparison of this effect between watersheds. Finally, the developed load-runoff relationships provide the basis for a simple, yet effective, method of predicting pollutant mass flows for individual or sequential storm events. (Sims-ISWS)
W79-04052

JUNE 1976 POLLUTION OF LONG ISLAND OCEAN BEACHES,
State Univ. of New York at Stony Brook.
R. L. Swanson, H. M. Stanford, J. S. O'Conner, S. Chanesman, and C. A. Parker.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 104, No. EE6, Proceedings Paper 14238, p 1067-1085, December 1978. 6 fig, 3 tab, 21 ref, 1 append.

Descriptors: *Beaches, *Pollutants, *Water pollution, *New York, Oceans, Shores, Harbors, Sewage, Waste disposal, Path of pollutants, Water pollution sources, Combined sewers, Waste dumps, Landfills, Waste disposal, Municipal wastes, *Beach pollution.

In June 1976, Long Island's ocean beaches were inundated with floating wastes, including sewage-related material, trash, and garbage. The material exited the Hudson-Raritan estuary as a result of high spring runoff and intensive May rains. Once introduced into New York Bight waters, it was transported to the beaches by persistent southerly winds. The major sources of the floatable wastes were urban runoff and a sewage treatment plant bypassing feeding through the combined sewer system. Assessment was accomplished by comparing waste materials found on the beaches with the types and volumes of materials associated with suspected sources. Continual washups of floatable material can be expected, particularly during summer months, until better source and screening control are implemented. (Sims-ISWS)
W79-04053

THE EFFECT OF ICE COVER ON VERTICAL TRANFER IN STREAM CHANNELS,
Clarkson Coll. of Technology, Potsdam, NY. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2E.
W79-04062

AMMONIA IN TEXAS STREAMS DURING LOW FLOW FROM MUNICIPAL WASTEWATER,
Texas Univ. Health Science Center at Houston. School of Public Health.
E. M. Davis, T. D. Downs, and W. G. Gray.
Water Resources Bulletin, Vol. 14, No. 6, p 1417-1422, December 1978. 1 fig, 1 tab, 8 ref.

Descriptors: *Ammonia, *Toxicity, *Waste water(Pollution), *Texas, Fish toxins, Pollutants, Nitrogen, Nitrates, Nitrites, Municipal wastes, Effluents, Streams, Streamflow, Data processing, Water quality, Water pollution, Water pollution sources.

An investigation of treated municipal wastewaters discharged into Texas streams was conducted to determine the probable effect of concentrations of ammonia in receiving waters. The investigation was based on existing data on ammonia levels which are lethal to various species of fish. Recorded data for most Texas cities were analyzed. Based on existing toxicity criteria for ammonia of 1/10 TL sub m = 0.31 mg/l NH3-N, employing known discharge flow rates, and 7-day, 5-year or 7-day, 10-year low flows in Texas streams, appreciable numbers of sites were found to pose a threat to various species of fish. Using the bluegill as a median tolerance limit species, data from 65 cities which met the aforecited requirements were analyzed. The requirements included a total of 92 wastewater effluents. Sixty-nine percent of those cities and 70% of their effluents exceeded the 0.31 mg/l NH3-N limit in the stream below the discharge point; 37% of the cities equaled or exceeded the 96-hour TL sub m concentration limit of 3.1 mg/l ammonia. Based on the 10 mg/l NO3-N standard for intake water for potable supplies, 32% of the effluents resulted in a stream concentration which exceeded 10 mg/l, assuming a straight conversion of NH3-N to NO3-N. (Sims-ISWS)
W79-04063

A MODEL OF THE BEHAVIOR OF PH DETERMINING PARAMETERS IN IMPOUNDMENTS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. A. Chadderton, and R. M. Shane.
Water Resources Bulletin, Vol. 14, No. 6, p 1357-1373, December 1978. 6 fig, 2 tab, 10 ref.

Descriptors: *Hydrogen ion concentration, *Model studies, *Reservoirs, Mathematical models, Computer models, Acids, Mine acids, Mine water, Acid mine water, Coal mines, Carbon dioxide, Impoundments, Lakes, Alkalinity, Water quality, Pollutants, Water pollution, *Loyalhanna Creek Reservoir.

A computer model capable of describing the behavior of pH-determining parameters in an impoundment was presented. The steady-state model, based upon principles of water chemistry, applied the complete-mix concept to the routing of the chemical quantities, alkalinity, and CO2-acidity. An iterative procedure was used to account for surface mass transfer of carbon dioxide. A fourth-

degree polynomial was solved for the hydrogen ion concentration at each point of routed alkalinity and CO2-acidity concentrations. Field data required to verify and apply the model were described, including an example application to the Loyalhanna Creek Reservoir. (Sims-ISWS)
W79-04064

RADIUM-226 IN GROUND WATER OF WEST CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
R. F. Kaufmann, and J. D. Bliss.
Water Resources Bulletin, Vol. 14, No. 6, p 1314-1330, December 1978. 8 fig, 22 ref.

Descriptors: *Radium, *Groundwater, *Phosphates, *Florida, Sampling, Surveys, Water pollution, Water pollution sources, Water quality, Aquifers, Data processing, Statistics, Mining, Water table, Wells, Water wells, *Phosphate deposits, *Central Florida.

Principal U.S. phosphate production is from central Florida where mining, processing, and waste disposal practices intimately associate the industry with water resources. Available radium-226 data from 1966 and from 1973-1976 in mined and unmined mineralized areas and nonmineralized areas in the primary study area, Polk, Hardee, Hillsborough, Manatee, and De Soto counties, were studied using log-normal probability plots and nonparametric statistical tests for significant difference as functions of time, depth, and location. Plots of radium in the water table and Floridan aquifers for mineralized and nonmineralized areas indicate that neither phosphate mineralization nor the industry is a probable factor. For the Lower Floridan aquifer, three separate radium populations are indicated with geometric means of 0.7, 3, and 10 pCi/l. Geometric mean radium-226 content of the water table aquifer is 0.17 pCi/l. Radium in the Floridan aquifer in Manatee and Sarasota Counties is elevated relative to that in the water table and in other areas of Florida. For Sarasota County, geometric mean radium content of the water table is 15 pCi/l vs 7.5 pCi/l in the Floridan. Potential sources include shallow phosphate sediments, monazite sands, and possibly crystalline basement rocks or other strata unrelated to phosphatic zones of current economic interest. The existing radium-226 data base is rather marginal in terms of number and spatial distribution of analyses, particularly for the water table and Upper Floridan aquifer. Existing radium data do not substantiate widespread contamination of groundwater as a result of the phosphate industry. However, local contamination associated with specific operations has occurred. (Sims-ISWS)
W79-04065

DISTRIBUTION OF AUTOTROPHIC NITRIFYING BACTERIA IN A POLLUTED RIVER (THE PASSAIC),
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
V. A. Matulewich, and M. S. Finstein.
Applied and Environmental Microbiology, Vol. 35, No. 1, January 1978. p 67-71, 4 tab, 14 ref. OWRT A-030-NJ(5).

Descriptors: *Water pollution, Waste water(Pollution), Rivers, *Passaic River(NJ), Bacteria, Nitrification, Nitrates, Sediments, Ammonia, *New Jersey, *Nitrifying bacteria.

The nitrification component of a proposed waste load allocation scheme for the Passaic River was challenged by a regional planning group on the basis that the sequence of nitrogen transformations characteristic of nitrification is not observed with downstream progression. Investigation of the distribution of nitrifying bacteria in the river showed that, on the average, nitrifying bacteria were most numerous in association with the rooted aquatic plants, followed by rock scrapings, algae, and surface sediment. Ammonium oxidizers in the surface sediment outnumbered those in the water by a factor of 540 and nitrite oxidizers did so by 250. Ammonium oxidizer most-probable-numbers (MPNs) were highest from approximately 2 to 5 cm, decreasing thereafter. Nitrite oxidizers decreased sharply in number at depths greater than 10 cm. The presence of higher nitrate levels in surface sediment than in water suggests that the sediment is a relatively active site of nitrification. (Chilton-ORNL)
W79-04070

DISTRIBUTION OF ARSENIC IN SOIL PROFILES AFTER REPEATED APPLICATIONS OF MSMA,
Auburn Univ., AL. Dept. of Soils.
A. E. Hiltbold, B. F. Hajek, and G. A. Buchanan.
Weed Science, Vol. 22, No. 3, p 272-275, May 1974. 1 fig, 3 tab, 12 ref. OWRT A-027-ALA(1).

Descriptors: *Arsenic, Soil leaching, *Monosodium methanearsonate, MSMA, Soil profiles.

Arsenic as MSMA (monosodium methanearsonate) was applied to three soil types over a 6-year period. Percentage recovery of applied arsenic averaged 67, 57, and 39% in Hartsells fine sandy loam, Decatur silt loam, and Dothan loamy sand soils, respectively. Essentially all of the arsenic recovered in the soils occurred in the plow layer with no evidence of leaching into deeper zones. Batch-equilibrium and soil-column studies in the laboratory indicated that the rate of MSMA movement through the surface horizon would be fastest in Dothan loamy sand and slowest in Decatur silt loam.
W79-04085

THE ROLE OF STREAMS IN POLLUTION DILUTION AND DISPERSION,
Oklahoma Univ., Norman. School of Civil Engineering and Environmental Science.
H. Silva, and J. F. Harp.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 935, Price codes: A03 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Institute. Oklahoma State University, Stillwater. Technical Completion Report, September 1978. 42 p, 7 fig, 4 tab, 6 ref. OWRT-A-083-OKLA(1).

Rock Creek at Sulphur, Oklahoma, was studied to determine the existing water quality, and to measure water quality of selected points along the stream. A description of the Rock Creek watershed area includes a discussion on beneficial uses and water quality, a hydrological description of the creek, and sources of pollution to the creek. A discussion of mathematical modeling of natural water bodies is followed by the presentation of mathematical models for the three sampling stations, 7, 14, and 18. Mathematical modeling was developed in two phases. Phase 1 is based on data obtained from an earlier study, and included data for dissolved oxygen (DO), fecal coliform, organic nitrogen, and total phosphorus for each of the three stations. In phase II data was obtained to develop models for DO, organic nitrogen, and total phosphorus. Each model with its statistical analysis for validity is presented. It is concluded that modeling of the stream is statistically accurate, and that simulation of different conditions is reliable. High concentrations of phosphorus shown during the study are thought to be unique to this stream at this time; nitrogen concentrations were below the applicable standards. (Davison-IPA)
W79-04118

SOUTH PLATTE RIVER BASIN ACCOMPLISHMENT PLAN.
Environment Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5G.
W79-04145

A RATIONAL APPROACH FOR OPTIMIZING APPLICATION RATES OF FERTILIZER NITROGEN TO REDUCE POTENTIAL NITRATE POLLUTION OF NATURAL WATERS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
B. Singh, C. R. Biswas, and G. S. Sekhon.
Agriculture and Environment, Vol. 4, No. 1, p 57-64, April, 1978. 3 fig, 2 tab, 6 ref.

Descriptors: *Nitrogen, *Fertilizers, Nitrates, *Water pollution sources, Wheat, Sweet corn, Crop response, Leaching, Crop production.

Yield, N uptake and residual NO3(-)-N data for wheat and maize, raised in a long-term experiment, have been discussed to determine optimum rates of fertilizer N aplication at which yeilds are least affected, while unused nitrogen, whch is a potential pollutant, is reduced to a permissible level. Computation of fertilizer N rates corresponding to the points of greatest economic return and permissible N loss has been described. Optimum fertilizer N rate is the smaller of the two fertilizer N rates. By assuming a loss of 60 kg N/ha or less, as environmentally permissible, it was observed that a small yield increment of maize would have to be sacrificed for the protection of the enivronment; whereas, for wheat, nitrogen can be applied safely up to the point of greeatest economic return. Coincidence of the rainy season with the growth period of maize in the study area seems to have reduced the fertilizer N rate, corresponding to the point of permissible N loss, lower than that for greatest economic return. (Skogerboe-Colorado State)
W79-04162

NON-POINT POLLUTION AND THE SCS,
For primary bibliographic entry see Field 6E.
W79-04197

EFFECTS OF EVAPORATIVE SALT WATER COOLING TOWERS ON SALT DRIFT AND SALT DEPOSITION ON SURROUNDING SOILS,
Texas Agricultural Experiment Station, College Station.
R. P. Wiedenfeld, L. R. Hossner, and E. L. McWilliams.
Journal of Environmental Quality, Vol. 7, No. 2, p 293-298, April-June, 1978. 5 fig, 2 tab, 15 ref.

Descriptors: *Cooling towers, *Saline water, Saltation, Environmental effects, Texas, Evaporation, *Soil contamination.

Five salt water cooling towers recently constructed near Galveston Bay, Texas have been shown to contribute to salt deposition in the surrounding area. Levels as high as 1,200 kg/ha per year of total salt were encountered within 100 m of the towers, but decreased in a logrithmic fashion with distance to <300 kg/ha per year at 434 m with only 16% attributable to the cooling towers. The remaining deposition was caused by natural sea spray which varies widely but average about 250 kg/ha per year in the study area. Changes in composition of air-borne salts with distance from the cooling towers were noted, primarily as a narrowing of the Na/Ca ratio. Salinity levels in the soil are in equilibrium with naturally deposited salts. Enhanced salt deposition levels due to the cooling towers initially caused only slight effects in the soils closest to the towers, but may eventually lead to both salinization and solonization in the surrounding vicinity. (Skogerboe-Colorado State)
W79-04220

A STUDY OF THE FATE OF SUSPENDED SOLIDS FROM A FULL-SCALE TREATMENT PLANT IN RECEIVING WATERS,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
H. S. Costa, D. L. Borton, and J. J. McKeown.
NCASI Stream Improvement Technical Bulletin No. 313, June, 1978. 44 p, 8 fig, 10 tab, 20 ref, 1 append.

Descriptors: *Pulp wastes, *Suspended solids, Wastes, Industrial wastes, Water pollution sources, Pulp and Paper industry, Effluent, Oxidation ponds, Aerated lagoons, Surface waters, Sediments, Invertebrates, Carbon radioisotopes, Oxidation, Carbon dioxide, Food chains, Board mills.

Carbon 14-labeled glucose was added to the 10-day aerated stabilization basin at a boxboard mill in order to trace the fate of suspended biosolids in the effluent discharged to a stream. Sediment traps placed in pools behind dams (where earlier studies found no discernible bottom deposits) captured less than 4% of the discharged solids. Over 96% of the discharged solids remained suspended or were oxidized in this stream whose velocities were less than an order of magnitude lower than normally associated with scouring of organic particles. Macroinvertebrates recovered from the rapidly flowing and completely mixed sections of the stream between pools contained measurable quantities of carbon-14. Residual biosolids were ingested and then incorported into the cellular materials of aquatic food chain organisms. Oxidation followed by release of carbon dioxide to the atmosphere is believed to be the major sink for total suspended solids discharged from biological treatment systems. (Swichtenberg-IPC)
W79-04225

TRITIUM TRACING OF UNSATURATED MOISTURE MOVEMENT,
Clemson Univ., SC. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W79-04266

SIMAZINE RESIDUES IN CANAL WATER AND CROPS RESULTING FROM EXPERIMENTAL APPLICATION FOR DITCHBANK WEED CONTROL,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. C. Pringle, L. W. J. Anderson, N. E. Otto, R. W. Raines, and U. T. Jackson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 173, Price codes: A03 in paper copy, A01 in microfiche. Report No. REC-ERC-78-1, May 1978. 33 p, 38 fig, 7 tab, 23 ref, 2 append.

Descriptors: *Pesticide residues, *Path of pollutants, *Simazine, Herbicides, Movement, Pesticide kinetics, Soil contamination, Water pollution, Food chains, Canals, On-site tests, Weed control, Irrigation, Irrigation effects.

Canals in California, Colorado, and Washington State were selected for a field study to determine the amount of simazine likely to be found in irrigation water following ditch bank treatment for weed control. Simazine was applied to both watered and dewatered sites at rates of 2.25 kg/ha (2 lb/acre) and 4.5 kg/ha (4 lb/acre). Immediately after the application, simazine levels detected in flowing canal water did not exceed 60 micrograms/L. The following spring first flow samples collected from the dry application sites peaked at 250 micrograms/L within the treated section, but dropped to less than 5 micrograms/L. In a correlated study six crops were irrigated with water containing 0.01 and 0.1 micrograms of simazine and harvested seven and 30 days after treatment. Trace amounts of herbicide were found in sugar beets, corn foliage, and tomatoes. Larger amounts were found in sugar beet foliage, and alfalfa contained the largest amounts of residue of the crops tested. No simazzine residue was found in corn grain, pinto bean pods and foliage, and cucumbers. According to a literature review, crop and canal water residue levels resulting from the experimental applicaton of simazine to inside slopes of canal banks were within established tolerance for potable water, and would produce no significant impact on crops and nontarget aquatic organisms. (Davison-IPA)
W79-04267

SALINITY EFFECTS ON GROWTH AND TOXIN CONTENT OF GONYAULAX EXCAVATA, A MARINE DINOFLAGELLATE CAUSING PARALYTIC SHELLFISH POISONING,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
A. W. White.
Journal of Phycology, Vol. 14, p 475-479, 1978. 3 fig, 17 ref.

Descriptors: *Growth rate, Dinoflagellate, Phytoplankton, *Salinity, *Toxicity, *Public health, Commercial shellfish, Gonyaulax, Saxitoxin, Toxin content, Laboratory tests, Growth curves.

The optimum salinity for growth of Gonyaulax excavata from Cape Ann, Massachusetts, is 30.5%, and it grows well over a range of 20-40%. It tolerates salinities of 11-43%. Growth rates at 24 and 20% are only ca. 10 and 20% less, respectively, than the maximum, 0.36 divisions/day. It is considered unlikely that salinity fluctuations in the coastal areas where this organism occurs significantly influence its growth rate. The paralytic toxin content in G. exacavata increases with increasing salinity, up to 37%. Therefore, the degree of toxicity of the organism in nature may be influenced by this environmental factor. (Katz-EIS)
W79-04313

FIRTH OF FORTH OIL POLLUTION INCIDENT, FEBRUARY 1978,
Royal Society for the Protection of Birds Sandy (England).
L. H. Campbell, K. T. Standring, and C. J. Cadbury.
Marine Pollution Bulletin, Vol. 9, p 335-339, 1978. 3 fig, 4 tab, 8 ref.

Descriptors: *Oil spills, *Waterfowl, *Toxicity, Mortality, Ducks(Wild), Water birds, Animal groupings, Animal behavior, Oil pollution, Oil, Fuels, Gulls, Organic compounds, Sewage treatment, *Crude oil.

Where seaducks and other waterfowl are highly concentrated, even small quantities of oil can be a major hazard. A pollution incident on the Firth of Forth in February 1978 was notable in that it affected 241 Great Crested Grebes as well as 700 diving ducks. Evidence is provided indicating that the slick passed close to the main wildfowl feeding area at night, oiling noctural-feeding Scaup and Pochard and a raft of roosting grebes, while Eider and Goldeneye, which had moved elsewhere to roost, largely escaped. The behaviour of freshly oiled birds is described. Heavily oiled Pochard flew 7 km inland to a loch before they were incapacitated. This is the sixth oil pollution incident to affect a large number of birds on the Forth since January 1970. (Deal-EIS)
W79-04316

THE INFLUENCE OF SALINITY ON TOXICITY OF CADMIUM AND CHROMIUM TO THE BLUE CRAB, CALLINECTES SAPIDUS,
Kelly High School Beaumont, TX.
For primary bibliographic entry see Field 5C.
W79-04319

EFFECT OF PCBS AND OTHER ORGANOCHLORINE COMPOUNDS ON THE HATCHABILITY OF ATLANTIC SALMON (SALMO SALAR) EGGS,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5C.
W79-04320

BIOMAGNIFICATION OF HEAVY METALS BY ORGANISMS IN A MARINE MICROCOSM,
Texas Univ. Health Science Center at Houston. School of Public Health.
R. K. Guthrie, E. M. Davis, D. S. Cherry, and H. E. Murray.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 53-61, 1979. 3 tab, 10 ref.

Descriptors: *Food webs, *Path of pollutants, Oysters, Clams, Crabs, Bottom sediments, Water chemistry, Metals, Heavy metals, Biological communities, Iron, Zinc, Manganese, Cadmium, Copper, Chromium, Mercury, Water analysis, Chemical analysis, *Bioaccumulation, *Tissue analysis, *Barium, *Selenium, *Arsenic, *Polychaetes, *Barnacles.

The objective was to study possible pathways of bioaccumulation by determining the relative bioaccumulation of ten selected, potentially toxic metals by the marine organisms comprising limited microcosms in two Texas bays. Concentrations of metals were measured in bay water, sediment, barnacle, crab, oyster, clam and polychaete. With the expection of Cu and Cd, barnacles had the highest concentration of each metal. Polychaetes most readily biomagnified Cd and Cu. The biomagnification of Zn, Cu and As by oysters in these environments may be hazardous to man. Clams appear to be very similar to oysters in biomagnification of metals in these microcosms. Crabs appear to be least likely to biomagnify the metals studied. (Deal-EIS)
W79-04322

INCREASE IN THE HUMAN BLOOD PCB LEVELS PROMPTLY FOLLOWING INGESTION OF FISH CONTAINING PCBS,
Osaka Prefecture Inst. of Public Health (Japan). Lab. of Food Chemistry.
K. Kuwabara, T. Yakushiji, I. Watanabe, S. Yoshida, and K. Yoyama.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 273-278, 1979. 4 fig, 11 ref.

Descriptors: *Polychlorinated biphenyls, *Animal physiology, *Foods, Chemical analysis, Path of pollutants, Animal metabolism, Gas chromatography, Pesticide residues, Pesticide kinetics, Lipids, Public health, *Tissue analysis.

Two human subjects ingested commercially obtained cutlass fish and immature yellowtail which had a known PCB contamination level. Blood levels of PCBs were monitored before and at intervals after ingestion. Within 3-5 hours after ingestion the levels of PCB rose to 1.5 and 1.6 times preingestion levels in the two subjects. Serum PCB levels returned to preingestion levels 24 hours after ingestion. (Deal-EIS)
W79-04326

FURTHER STUDIES ON BIFIDOBACTERIA AS INDICATORS OF FAECAL POLLUTION IN WATER,
Newcastle-upon-Tyne Univ. (Great Britain). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W79-04328

ELUTRIATE-PRIMARY PRODUCTIVITY BIOASSAYS OF DREDGE SPOIL DISPOSAL IN LAKE ERIE,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
R. W. Flint, and G. J. Lorefice.
Water Resources Research, Vol. 14, No. 6, p 1159-1163, 1978. 2 fig, 2 tab, 14 ref.

Descriptors: *Dredging, *Primary productivity, *Lake Erie, Bioassay, Sediments, Particle size, Suspended solids, Photosynthesis, Algae, Water Analysis, Sediment discharge, Radioactivity techniques, Analytical techniques, *Elutriate.

The standard sediment elutriate procedure was combined with radioactive primary productivity methods to evaluate impacts of dredged material disposal on pelagic primary producers. Seven treatment levels suggested that dredged material disposal inhibited algal photosynthesis at higher concentrations. The procedure developed reflected the 'bioavailability' of dissolved constituents released during deposition. The results also implied that particle formation within the water column during disposal may promote microbial (heterotrophic) growth. The procedure described is especially valuable in evaluating pelagic effects of dredged material disposal because of its use of natural populations, minimal expense, and, most importantly, short experimental duration compared to that of standard laboratory bioassays. (Deal-EIS)
W79-04329

RELATIONSHIP BETWEEN INDICATOR ORGANISMS AND SELECTED PATHOGENIC BACTERIA IN URBAN WATERWAYS,
Johns Hopkins Univ., Baltimore, MD Environmental Health.
For primary bibliographic entry see Field 5A.
W79-04330

OCCURRENCE OF TOXIC BIVALVES IN ASSOCIATION WITH GONYAULAX PLANKTONS IN ISE, OWASE, AND OFUNATO BAYS,
Tokyo Univ. (Japan). Faculty of Agriculture.
T. Noguchi, R. Adachi, M. Iguchi, H. Kamiya, and K. Hashimoto.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 11, p 1245-1248, 1978. 1 fig, 3 tab, 7 ref.

Descriptors: *Eutrophication, *Bivalves, *Toxicity, Clams, Mussels, Plankton, Poisons, Chemical analysis, Dinoflagellates, Commercial shellfish, Public health, Human pathology, Hazards, *Gonyaulax, *Tissue analysis, *Scallop, *Shellfish poison.

The occurrence of toxic bivalves was surveyed in several bays. Various bivalves, such as short-necked clam and mussel, collected in April and May, 1976, in Ise Bay showed a maximum toxicity of 100 MU/g of whole soft body. The mussel collected in January and February, 1977, in Owase Bay exhibited a maximum toxicity of 70 MU/g of whole soft body. In the former case, a Gonyaulax bloom occurred almost in parallel with the appearance of toxic bivalves, indicating their close association. In the latter case, no bloom was observed. On the other hand, as high toxicity as 800 MU/g was encountered with the mid-gut gland of scallop collected in May, 1976, in Ofunato Bay where no visible Gonyaulax bloom has so far been observed. The toxicity values of the ovary and adductor muscle of scallop were 45 and 20 MU/g, respectively. The possible relationship of toxic bivalves and Gonyaulax blooms was discussed. (Deal-EIS)
W79-04331

BEHAVIOR OF MERCURY IN BIOSYSTEMS. III. BIOTRANSFERENCE OF MERCURY THROUGH FOOD CHAINS,
Georgia Univ., Athens. Dept. of Food Science.
M. K. Hamdy, and N. V. Prabhu.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 170-178, 1979. 3 fig, 1 tab, 21 ref.

Descriptors: *Mercury, *Food chains, *Absorption, Trophic level, Bacteria, Mosquitoes, Cichlids, Larval growth stage, Radioactivity, Techniques, Tracers, Cytological studies, Chemical analysis, Path of pollutants, *Tissue analysis, *Bioaccumulation, *Biotransference, *Methylmercury, *Guppies.

This study was conducted to follow the biotransference of radioactive mercury in a simple model food chain which consisted of four trophic levels: from mercury resistant bacteria to mosquito larvae; then from larvae to guppies (small fish); and finally from guppies to Cichlids (big fish). It was observed that 203HG+2 is concentrated by two of the organisms used, namely the lower system (i.e. the bacterial cells and the larvae). These are the only systems that exhibited magnification of mercury in this study. The results obtained also showed that the concentration factors of the inorganic and organic mercury compounds via biotransference were different in the various trophic levels used. (Deal-EIS)
W79-04334

METHYLATED MERCURY IN BROOK TROUT (SALVELINUS FONTINALIS): ABSENCE OF AN IN VIVO METHYLATING PROCESS,
Oak Ridge National Lab., TN.
J. W. Huckabee, S. A. Janzen, B. G. Blaylock, Y. Talmi, and J. J. Beauchamp.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 848-852, 1978. 3 tab, 18 ref.

Descriptors: *Mercury, *Brook trout, *Fish physiology, Animal metabolism, Biochemistry, Path of pollutants, Gas chromatography, Chemical analysis, Growth rates, Food habits, Food chains, Absorption, *Tissue analysis, *Methylmercury, *Mercury compounds, *Bioaccumulation.

The possibility of in vivo conversion of inorganic mercury to MeHg in brook trout was tested by chronically exposing fish to mercury (from Hg(NO3)2) at a concentration of 1 ng/ml, for 56 days, and then maintaining them at background levels for 294 days. The concentrations of inorganic and methylated mercury (MeHg) in several organs of control and test fish were periodically measured over this 50-wk period. The inorganic mercury levels in test fish increased rapidly during exposure. The MeHg concentrations in both control and test fish increased slowly and at the same rate, with final 350-day concentrations comparable to levels found in wild brook trout from an uncontaminated area. This information indicates that fish do not methylate inorganic mercury in vivo, and that approximately one-half of the MeHg body burdens in the fish was acquired via the food. (Deal-EIS)
W79-04335

THE RELATIVE CONTRIBUTIONS OF METHYLMERCURY FROM FOOD OR WATER TO RAINBOW TROUT (SALMO GAIRDNERI) IN A CONTROLLED LABORATORY ENVIRONMENT,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
G. R. Phillips, and D. R. Buhler.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 853-861, 1978. 3 fig, 2 tab, 30 ref.

Descriptors: *Rainbow trout, *Mercury, *Path of pollutants, Fish behavior, Fish physiology, Absorption, Growth rates, Food habits, Water chemistry, Chemical analysis, Water quality standards, Animal metabolism, Heavy metals, *Tissue analysis, *Mercury compounds, *Methylmercury, *Bioaccumulation.

Rainbow trout accumulated methylmercury linearly during 24 days when continually exposed to methylmercury. Exposure was by means of water solutions (0.07-1.33 microg Hg/liter), food consumption (8.0-380.5 ng Hg/g fish per day) or both. Methylmercury accumulated from one source had no influence on the rate of uptake from the second source. Methylmercury accumulated from both sources was quantitatively additive, which validates a frequently used assumption. Food consumption rate and therefore growth rate had no influence on the rate of mercury accumulation from water. Nearly 70% of the methylmercury ingested and 10% of the methylmercury passed over the gills was assimilated. (Deal-EIS)
W79-04337

TOXICITIES OF CADMIUM, COPPER, AND ZINC TO FOUR JUVENILE STAGES OF CHINOOK SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
For primary bibliographic entry see Field 5C.
W79-04339

ACUTELY LETHAL LEVELS OF CADMIUM, COPPER, AND ZINC TO ADULT MALE COHO SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
For primary bibliographic entry see Field 5C.
W79-04340

TOXICITY OF TEXTILE WASTE TO SOME TELEOST FISHES,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5C.
W79-04341

PREDICTING LONGITUDINAL DISPERSION OF POLLUTANTS IN RIVERS,
Missouri Univ.- Columbia. Dept. of Civil Engineering.
H. Liu, and J. E. Dieter, III.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 136-143, 1977. 4 fig, 16 ref. OWRT A-094-MO(3).

Descriptors: Dispersion, *Pollutants, *Rivers, *Forecasting, Analytical techniques, Data collections, Canals, Streams, Flumes, Laboratory tests, Channel flow, Flow characteristics.

The crux in predicting the concentration of pollutants in rivers over long distances is how to determine the one-dimensional dispersion coefficient D (also called 'the longitudinal dispersion coefficient') of each river. At present, cumbersome and expensive tracer dilution measurements must be made in field before the magnitude of D for each case can be determined with reasonable accuracy. Since D varies widely not only from river to river and from one reach to another of the same river, but also from one discharge to another even for the same reach, it is impractical to rely solely on dye dilution studies for the determination of D. In 1977, Liu reported a method to predict the longitudinal dispersion coefficient of rivers and streams with an accuracy far exceeding the contemporary simple methods. Although existing data seem to suggest an improvement in predicting the dispersion coefficient, the present paper should be viewed as a progress report of ongoing research. (See also W77-05803 and W79-04351) (Humphreys-ISWS)
W79-04365

MODELING DISSOLVED OXYGEN IN THE NEAR-FIELD,
Tulane Univ., New Orleans, LA. Dept. of Civil Engineering.
B. A. Benedict.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 144-151, 1977. 2 tab, 12 ref.

Descriptors: *Dissolved oxygen, *Forecasting, *Dispersion, Diffusion, Distribution, Jets, Mixing, Rivers, Lakes, Water quality, Oxygen sag, Methodology, Near-field models.

The oxygen resources of a body of water usually are taken as a critical indicator of the quality of that water body. A discharge of material with an oxygen demand (expressed as biochemical oxygen demand, or BOD) may be very damaging to the oxygen resources of the receiving water body. Assessing the environmental impact of such a discharge requires an analysis of the behavior of these discharges and the resulting dissolved oxygen (DO) distribution in the receiving water. The model discussed is a preliminary version, and work is underway to study further the processes of mixing and to improve the model. Included were attempts to account for re-entrainment due to interaction with the near and far shores, improved treatment of the zone of flow establishment, and a linking of the jet model to diffusion models to carry the calculations downstream after jet behavior ceases. (See also W79-04351) (Humphreys-ISWS)
W79-04366

DYNAMIC STREAMFLOW-TEMPERATURE SIMULATION APPLIED TO THE BRAZOS-LITTLE RIVERS, TEXAS,
Utah Water Research Lab., Logan.
D. S. Bowles, D. L. Fread, and W. J. Grenney.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 269-279, 1977. 3 fig,

2 tab, 13 ref. UWRL WG 156.

Descriptors: *Water temperature, *Streamflow, *Model studies, *Texas, Water quality, Mathematical models, Hydrographs, Heat balance, Analytical techniques, Analysis, *Brazos River(TX), *Little River(TX), Thermograms.

Coupled dynamic streamflow and stream temperature models (DNRT-DSTEMP) were developed and applied. The results showed that surface heat exchange is more important than lateral inflow heat exchange in the heat balance of reach 13 of the Brazos River during the December 1972 flood. At present, the estimation of lateral inflow thermograms is mainly the result of intuitive guesses and trial-and-error matching of observed and predicted thermograms after the nonadvective heat transfer process is calibrated. An independent verification of the model is difficult because of the diverse characteristics of lateral inflow thermograms associated with different floods. Therefore, it would be necessary to perform a new trial-and-error estimation of the lateral inflow thermogram for each flood simulated. Thermograms for lateral inflows could be generated by linkage with a two-dimensional hydrology-water temperature model. DNRT-DSTEMP appears to be a very flexible tool for the dynamic simulation of streamflow-stream temperature. The coupled models are suitable for aplication in temperature simulation on small streams or large river systems. Dynamic aspects of the flow and temperature variations, such as those simulated by DNRT-DSTEMP, are essential to obtain predictions of critical, but transient, stream temperature conditions that may endanger aquatic environments. (See also W79-04351). (Humphreys-ISWS)
W79-04379

DIFFUSION OF DREDGED MATERIAL IN THE MISSISSIPPI RIVER,
Army Engineer District, New Orleans, LA.
C. Grimwood, and B. A. Benedict.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 313-319, 1977. 3 fig, 2 ref.

Descriptors: *Dredging, *Mississippi River, *Louisiana, *Dispersion, Sediment transport, Dissolved solids, Pollutants, On-site investigations, Monitoring, Water quality, Sampling, Mixing, Distribution, Mathematical models, *New Orleans(LA), Dredged material.

The objective of this investigation was to determine how the fate of the material released by a hydraulic cutterhead dredge in the immediate vicinity of the discharge during dredging operations in the New Orleans Harbor fits a simple mathematical diffusion model in the immediate vicinity of the discharge pipe. The observed concentration profiles of total and dissolved constituents showed that the effect of the dredge effluent on the concentration of the constituents considered is very short lived, and im most cases, completely disappears at distances greater than 60 feet downstream from the pipe. The use of a simple, one-dimensional model of the diffusion process can approximate reasonably, with some assumptions, the rate of reduction in concentration for some materials as a function of downstream distance from the pipe. The vertical and lateral distribution of different constituents in the immediate vicinity of the pipe changes considerably from one material to another. This difference in behavior from one material to another suggests that much more experimental work needs to be done to model adequately the behavior of the specific constituent considered. (See also W79-04351)(Humphreys-ISWS)
W79-04384

EFFECTS OF AMBIENT CURRENT AND DENSITY STRATIFICATION ON BUOYANT JETS,
California Inst. of Tech., Pasadena. W. M. Keck Lab. of Hydraulics and Water Resource.
S. J. Wright.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 336-343, 1977. 4 fig, 2 tab, 7 ref. NSF GK-35774X, ENG 75-02985.

Descriptors: *Jets, *Model studies, *Spatial distribution, *Flow characteristics, Water quality, Density stratification, Laboratory tests, Analytical techniques, Outlets, Dimensional analysis, Hydraulic models, Buoyant jets, Plumes.

This presentation considered the vertical discharge of a round, turbulent buoyant jet into a ambient fluid with a uniform horizontal velocity and a linear density stratification. This flow configuration is similar to the release of various pollutants to the environment. Examples include smoke plumes from industrial chimneys, cooling tower plumes, and sewage discharges from a single port into the ocean or other body of water. The asymptotic solutions developed by the simplified flow descriptions and dimensional analysis were observed to represent adequately the characteristic behavior of buoyant jets. This includes jet trajectories in an unstratified flow, characteristic dilutions, and maximum and equilibrium heights of rise for stratified cross-flows. An important observation is that the constants predicted by the analysis were found to depend upon other parameters not considered in the simplified flow descriptions. This variation can be taken as a minor adjustment to the basic model and can be anticipated by dimensional reasoning. The general model can be used along with the experimentally measured values of the coefficients to predict flow properties which may be of interest in the design of buoyant jet discharges to release various pollutants to the environment. (See also W79-04351)(Humphreys-ISWS)
W79-04387

TIME OF TRAVEL OF SOLUTES IN LOUISIANA STREAMS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
A. J. Calandro.
Louisiana Department of Public Works Water Resources Technical Report No. 17, 1978. 32 p, 19 fig, 1 tab, 10 ref.

Descriptors: *Path of pollutants, *Flow rates, *Tracers, *Louisiana, *Streams, Tracking techniques, Fluorescent dye, Mathematical models, Estimating, Equations, Dispersion, *Accidental spills, *Time of travel.

This report summarizes the traveltime and dispersion of solutes in 18 streams in Louisiana that were measured by injecting a fluorescent water tracer. Nine of the streams were studied through a range of discharges. The relations of unit concentration and traveltime to discharge in these streams are presented graphically to enable prediction of the traveltimes for contaminants downstream from accidental spills. In addition, standard multiple-linear regression techniques, relating traveltime and dispersion characteristics to basin parameters, were used to develop equations for estimating traveltimes, dispersion of solutes, and peak concentrations for ungaged streams in Louisiana. Examples of use and application of the data and the predictive equations are given. (Woodard-USGS)
W79-04401

GROUND WATER OF THE FORT UNION COAL REGION, EASTERN MONTANA.
Geological Survey, Helena, MT. Water Resources Div.
Montana Bureau of Mines and Geology Special Publications 80, 1978. 47 p.

Descriptors: *Water quality, *Groundwater, *Coal mine wastes, *Strip mines, *Montana, Shallow water, Hydrogeology, Aquifers, Seismic studies, Groundwater movement, Groundwater recharge, Water level fluctuations, Water wells, *Fort Union Coal Region, Saline seeps.

The hydrologic findings of numerous studies recently completed or currently underway by the Montana Bureau of Mines and Geology and the U.S. Geological Survey are described. Pertinent facts are given on the occurrence, movement, and quality of ground water in the Fort Union Coal Region of Montana. The present development, effects of seismic shotholes on ground-water systems, and effects of strip mining of coal on shallow ground-water systems are described also. The primary purpose of the report is to provide basic factual material on ground-water conditions to assist nontechnical readers in understanding the complex ground-water problems existing in eastern Montana. (Woodard-USGS)
W79-04405

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
For primary bibliographic entry see Field 5D.
W79-04421

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 6E.
W79-04425

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

NONPOINT SOURCE POLLUTION,
For primary bibliographic entry see Field 5A.
W79-04443

THE USE OF CIVIL PENALTIES IN ENFORCING THE CLEAN WATER ACT AMENDMENTS OF 1977,
For primary bibliographic entry see Field 6E.
W79-04449

POPE V. CITY OF ATLANTA (ACT REGULATING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITUTIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
For primary bibliographic entry see Field 6E.
W79-04452

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

NON-POINT SOURCE POLLUTION STUDIES IN THE CHINCOTEAGUE BAY SYSTEM,
Virginia Inst. of Marine Science, Gloucester Point, VA. Dept. of Physical Oceanography and Hydraulics.
C. F. Cerco, C. S. Fang, and A Rosenbaum.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 338, Price codes: A09 in paper copy, A01 in microfiche. Special Scientific Report No. 86 April 1978, 174 p, 37 ref. Intensive Hydrographical and Water Quality Survey of the Chincoteague Sinepuxent/Assawoman Bay Systems, 25 tab, 9 ref.

Descriptors: *Storm runoff, *Mathematical models, *Maryland, Water pollution, Estuarine environment, Virginia.

Based on field data collected from ten sample sites encompassing seven land uses, the U.S. Army Corps of Engineer's STORM model has been calibrated and applied to the watershed of the Chincoteague Bay System located on the eastern shores of Delaware, Maryland, and Virginia. Current and

projected year 2000 non-point source pollution loads have been calculated and current loads have been compared with point source discharges and storm-generated marsh nutrient exports. Point sources are responsible for larger quantities of ammonia and phosphorus while non-point sources contribute greater amounts of nitrate and coliforms. Rough equivalence is noted in the contributions of organic nitrogen and BOD5. A single storm on the local marshes, however, can produce nutrient export of the same order of magnitude as the monthly average point or non-point source loads from the remainder of the basin.
W79-04488

RETENTION AND LEACHING OF NUTRIENTS IN A LIMED ULTISOL UNDER CROPPING,
International Inst. of Tropical Agriculture Ibadan (Nigeria).
A. S. R. Juo, and J. C. Ballaux.
Soil Science Society of America Journal, Vol. 41, No. 4, p 757-761, July-August, 1977. 3 fig, 6 tab, 15 ref.

Descriptors: Maize, *Leaching, Nutrients, Greenhouses, Soils, Soil investigations, Crop response, Crop production, *Lime.

The response of maize to liming and the retention and leaching of Ca and other nutrient ions were studied in the greenhouse using an acid Ultisol from southern Nigeria. The soil was limed to various pH levels and maize was grown for 10 weeks. The largest growth response occurred when the soil pH as raised from 4.3 to 5.0 by liming (1.3 metric ton/ha). The highest yield was obtained when the soil pH was between 5.5 to 6.0. Substantial downward movement of Ca from the limed surface layer was noted, but these Ca ions were mostly adsorbed in the unlimed subsurface layer. Leaching losses of applied nutrient ions (Ca, Mg, K, NO3) were relatively small. There was a significant increase in nitrate content in leachates when soil was limed above pH 7.0. (Skogerboe-Colorado State)
W79-04500

5C. Effects Of Pollution

EARTHWORM POPULATIONS, SOIL BULK DENSITY, POROSITY, AND WATER STABLE AGGREGATES UNDER EFFLUENT APPLICATION,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
L. T. Newell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 846, Price codes: A08 in paper copy, A01 in microfiche. Ms Thesis, July 1977. 142 p, 17 fig, 15 tab, 88 ref, 3 append. OWRT B-048-NY (2).

Descriptors: *Soil properties, *Biomass, *Sewage effluents, *Earthworms, Municipal wastes, Soil amendments, Soil texture, Soil analysis, Soil aggregates, Soil formation, Soil density, Soil tests, Porosity, Soil treatment, Municipal wastes.

Eleven species of earthworms were collected from six sample plots in a study conducted to examine earthworm populations and soil properties, and to comparing plots treated with municipal sewage effluent and untreated (control) plots. The three study areas consisted of a plot treated with a fixed amount of sewage effluent added to the soil and an adjacent untreated plot having the same soil type and vegetative cover. It was determined that soil treated with municipal sewage effluent resulted in an increase in earthworm numbers and biomass. This treatment fostered the growth of Dendrobaena species on the Mixed Hardwood Oak (MHO) plot and of the Lumbricus species on the Reed Canary Grass (RCG) an Old Field (OF) plots. Significant seasonal differences in bulk density and porosity were consistent on the treated RCG plots. On the MHO the treatment resulted in an increase in the smaller water stable aggregates, while the larger water stable aggregates increased on the treated RCG and OF plots. It is concluded that the overall effects of municipal sewage treatment are beneficial to earthworm populations. (Davison-IPA)
W79-04005

DISTRIBUTION OF AUTOTROPHIC NITRIFYING BACTERIA IN A POLLUTED RIVER (THE PASSAIC),
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W79-04070

EFFECTS OF NON-POINT POLLUTION ON BENTHIC INVERTEBRATES IN THE LYNNHAVEN RIVER SYSTEM,
Old Dominion Univ., Norfolk, VA. Dept. of Biological Sciences.
D. M. Dauer, W. W. Robinson, C. P. Seymour, and A. T. Legett, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 910, Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University Bulletin 117, February 1979. 112 p, 37 fig, 12 tab, 44 ref, 2 append. OWRT A-075-VA(1).

Descriptors: Estuaries, *Non-point sources, Urbanization, *Benthic fauna, Oysters, Lynnhaven River, Virginia, Nutrient enrichment.

Increased urbanization and non-point sources of pollution in the area of Virginia's Lynnhaven River complex have increased the nutrient content of the adjacent waters, with possible enrichment effects. This research assessed the biological effects of these non-point discharges on estuarine macroinvertebrates in the Western and Eastern branches of the river. First, individual oysters in the Lynnhaven were monitored for growth to determine whether nutrient enrichment enhanced or impeded growth in areas of different water quality. In addition, 10 permanent sites located in the river's intertidal zone from the inlet at the mouth to the headwaters of both branches were used to sample benthic infaunal macroinvertebrate communities. Such biological parameters as species numbers, community density, and community biomass were studied at each site by collecting bimonthly samples (August 1976-June 1977). For comparison, benthic invertebrate samples were collected from Old Plantation Creek in Virginia's Eastern Shore. These data indicate that no significant deterioration of water quality has occurred in the study areas of the Lynnhaven. Results show that macroinvertebrate communities of the Lynnhaven are dominated by a group of animals that are naturally adapted to withstand environmental stress. Comparing the spatial and temporal distribution patterns for each individual species in the Lynnhaven with samples collected in Old Plantation Creek, indicates that the amount of stress placed upon the Lynnhaven's environment by non-point pollution probably has little or no influence upon the natural benthic invertebrate populations.
W79-04071

TRANSIENT TEMPERATURE EFFECTS ON BOD AND DO CONCENTRATIONS ALONG A STREAM,
Kansas State Univ., Manhatten. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W79-04087

INFLUENCE OF DOMESTIC WASTES ON ENERGETIC PATHWAYS IN ROCKY INTERTIDAL COMMUNITIES,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, and S. N. Murray.
Journal of Applied Ecology, Vol. 15,p 583-595, 1978. 2 fig, 3 tab. (California Water Resources Center Project UCAL-WRC-W-49). OWRT A-054-CAL(5).

Descriptors: *Algae, *Intertidal areas, *Biological communities, *Sewage effluents, *Domestic wastes.

The calorific contents of eighteen macroinvertebrates and thrity-six macrophytes were determined in an unpolluted rocky intertidal habitat and in a nearby polluted habitat. Much of the variation in the calorific values of macrophytes was related to life span. The algae that characterized the unpolluted community usually contained comparatively fewer calories per unit weight. These forms had relatively more structural tissues and hence allocated relatively less energy to rapid growth and reproduction. In the polluted habitat, fugitive or opportunistic algal species were more prevalent; these had more rapid growth rates and higher productivities and tended to have relatively high calorific contents. Encrusting forms, that are easily accessible to many herbivores, had thallus constituents with lower calorific vaues, suggesting that these algae may have evolved reduced palatability. The major taxonomic groups of algae yielded the following sequence of mean calorific values: Chlorophyta, 4.78 kcal g(-1) ash-free weight; Rhodophyta, 4.39; Cyanophyta, 4.38; Phaeophyta, 4.22. In nearly every case, macroinvertebrate populations exposed to domestic sewage had higher energy contents than did corresponding populations from the unpolluted habitat. Macroinvertebrates in polluted habitat grazed greater proportions of blue-green algae and bacteria. Omnivores and suspension feeders in the polluted habitat appeared to utilize energy-rich compounds in the sewage effluent; this may explain the greater standing stocks of omnivores in the peripheral regions of outfall plume. (Snyder-California-Davis)
W79-04133

INVESTIGATION OF THE LONG-TERM EFFECTS OF CHLORINE ON THE OXYGEN DEMAND OF WASTEWATERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W79-04160

ENVIRONMENTAL EFFECTS OF WESTERN COAL SURFACE MINING, PART II: THE AQUATIC MACROINVERTEBRATES OF TROUT CREEK, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
S. P. Canton, and J. V. Ward.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-289 883, Price codes A04 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-095, October 1978. 71 p, 8 fig, 23 tab, 45 ref, 3 append. R803950.

Descriptors: *Invertebrates, *Coal mines, *Trout Creek(Colorado), :Mine acids, *Environmental effect, Biology, Aquatic insects, Aquatic environment, Caddisflies, Water pollution, Water pollution sources, Biomass, Benthos, Standing crops, Aquatic life, Biota, Strip mines, Strip mine wastes, Mine drainage.

A study conducted over a 21 month period on Trout Creek in Colorado assessing the effects of coal mine drainage on stream macroinvertebrates is reported. Throughout the study area density and biomass showed a general increase, in the downstream direction with significant seasonal variations. Over 90% of the fauna were aquatic insects, most of which were caddisflies. During the study period there were no definite indications of stressed conditions in the macroinvertebrate community. The invertebrates appeared able to withstand the period of water quality degradation resulting from the spring runoff. It is thought that the buffer zone existing between the mine and the creek decreases the effects of mine drainage, and therefore it should remain to insure the stability of the macroinvertebrate community. (Davison-IPA)
W79-04252

SIMAZINE RESIDUES IN CANAL WATER AND CROPS RESULTING FROM EXPERI-

MENTAL APPLICATION FOR DITCHBANK WEED CONTROL,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 5B.
W79-04267

BEHAVIOR AND TRANSPORT OF MERCURY IN RIVER-RESERVOIR SYSTEM DOWNSTREAM OF INACTIVE CHLORALKALI PLANT,
Oak Ridge National Lab., TN. Environmental Sciences Div.
R. R. Turner, and S. E. Lindberg.
Environmental Science and Technology, Vol. 12, No. 8, p 918-923, August, 1978.

Descriptors: *Mercury, *Water pollution, *Virginia, Wastes, Industrial wastes, Water pollution sources, Metals, Chemical wastes, Suspended load, Bottom sediments, Sediments, Toxicity, Silts, Clays, Waste dilution, Chlor-alkali plant, Holston River(Virginia), Reservoirs, Rivers, Surface waters.

Aquatic losses of mercury from a former chlor-alkali plant (closed in 1972) located on the north fork of the Holston River, Virginia, continues to cause elevated levels of mercury in downstream water, suspended matter, and bottom sediment. These losses are attributed to leaching of soluble mercury in solid wastes located at the site and have recently amounted to about 39 kg/yr. Concentrations of mercury in water and suspended matter immediately downstream of the plant site are typically 20 times higher than immediately upstream. The silt-clay fraction of bottom sediment immediately downstream of the plant site contains up to 200 times as much mercury as similar sediments collected immediately upstream. Field observations and application of a simple dilution model indicate that rapid decreases in mercury concentrations in water as a function of distance below the plant site could be accounted for partially by dilution, although up to 60% of the observed decreases are apparently related to nondilution processes. (Louden-IPC)
W79-04290

HISTOPATHOLOGICAL AND PHYSIOLOGICAL RESPONSES OF FUNDULUS HETEROCLITUS TO NAPTHALENE EXPOSURE,
Delaware Univ., Newark. School of Life and Health Sciences.
L. DiMichele, and M. H. Taylor.
Journal of the Fisheries Research Board of Canada, Vol. 35, No. 8, p 1060-1066, 1978. 3 fig, 3 tab, 22 ref. OWRT A-043-DEL(1). 14-34-0001-8008.

Descriptors: Toxicity, *Naphthalene, Teleosts, Histopathology, Fundulus, Mummichog, *Fish diseases.

Mummichogs, Fundulus heteroclitus, were exposed to napthalene concentrations ranging from 30 to 0.002 mg/L over time periods ranging from 1 to 15 d. Histopathology of exposed animals was evaluated. Major effects were found in the brain, liver, and pancreas down to 0.2 mg/L for a 15-d exposure. The results of these experiments indicate that the toxicity of napthalene in this fish is due primarily to its effect on blood components. There was also evidence of neurosensory damage at exposures as low as 0.02 mg/L for 15 d. In addition, serum glucose, protein, and cortisol were measured in animals exposed to low levels of napthalene for 15 d. All were significantly elevated, indicating metabolic stress at exposures as low as 0.02 mg/L. C-napthalene uptake was measured at two concentrations of napthalene. Napthalene was found to accumulate in significant amounts in organs most susceptible to pathology. The distribution of naphthalene was found to be independent of its water concentration in all organs tested except the spleen.
W79-04312

SALINITY EFFECTS ON GROWTH AND TOXIN CONTENT OF GONYAULAX EXCAVATA, A MARINE DINOFLAGELLATE CAUSING PARALYTIC SHELLFISH POISONING,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5B.
W79-04313

TOXICITY OF CUPRIC ION TO EGGS OF THE SPOT LEIOSTOMUS XANTHURUS AND THE ATLANTIC SILVERSIDE MENIDIA MENIDIA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
D. W. Engel, and W. G. Sunda.
Marine Biology, Vol. 50, p 121-126, 1979. 1 fig, 3 tab, 10 ref.

Descriptors: *Copper, *Toxicity, *Fish eggs, Fish reproduction, Fish physiology, Growth stages, Ions, Metals, Chemical reactions, Chemical analysis, Copper sulfate, Inhibition, Chelation, Mortality, Trophic level, *Leiostomus, *Menidia, *Buffers, Marine fish.

Experiments were conducted to determine the toxicity of free cupric ion to the eggs of two marine fish: the spot and the Atlantic silverside. A cupric ion buffer consisting of 5 mM of the chelator, trishydroxy-methylamino methane (Tris), and varied concentrations of CuSO4 was employed to achieve stable cupric ion activities in experimental seawater media. Egg hatch of the silverside appears to be more sensitive to cupric ion than that of the spot. The silverside had 60% inhibition of hatch at a pCu (negative logarithum of cupric ion activity) of 9.4 with complete suppression of hatching at pCu values below 8.2, while the spot had 50% inhibition at a pCu of 9.0 and complete suppression at a pCu of 8.0. Cupric ion was most toxic to the eggs of silverside at or around the time of hatching, whereas a pronounced sensitivity at hatching was not apparent with the eggs of spot. Calculated estimates of the range of cupric ion activity in seawater indicate that natural activity levels may in some instances inhibit the hatching of silverside and spot eggs. (Deal-EIS)
W79-04314

THE EFFECT OF PETROCHEMICAL STRUCTURE ON METHANE FERMENTATION TOXICITY,
Drexel Univ., PA. Environmental Studies Inst.
For primary bibliographic entry see Field 5A.
W79-04315

FIRTH OF FORTH OIL POLLUTION INCIDENT, FEBRUARY 1978,
Royal Society for the Protection of Birds Sandy (England).
For primary bibliographic entry see Field 5B.
W79-04316

EFFECTS OF NO. 2 FUEL OIL ON HATCHABILITY OF MARINE AND ESTUARINE BIRD EGGS,
Fish and Wildlife Service, Victoria, TX. Gulf Coast Field Station.
D. H. White, K. A. King, and N. C. Coon.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 7-10, 1979. 2 tab, 5 ref.

Descriptors: *Mortality, *Oil, *Water birds, *Bird eggs, Embryonic growth stage, Gulls, Oil spills, Oil pollution, Fuels, Organic compounds, Toxicity, Hatching, Reproduction, Nests, Fertility, *Herons, *Terns.

Eggs of Louisiana herons, sandwich terns, and laughing gulls were oiled with either 0, 5, or 20 microliters of No 2 fuel oil in the field and in the laboratory. After 5 days of natural incubation, field-oiled and control eggs were opened and embryonic mortality was determined. No 2 fuel oil produced 61% mortality in Louisiana heron eggs, 56% in sandwich tern eggs, and 83% in laughing gull eggs. Hatching success of artificially incubated, oiled eggs appeared to be lower than in control eggs. However, stress during shipment to the laboratory and problems within the incubator probably contributed to reduced hatchability in both groups. (Deal-EIS)
W79-04317

EFFECTS OF TRICHLOROETHYLENE, HEXACHLOROBENZENE AND POLYCHLORINATED BIPHENYLS ON THE GROWTH AND CELL SIZE OF MARINE PHYTOPLANKTON,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
D. C. Biggs, R. G. Rowland, and C. F. Wurster.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 196-201, 1979. 1 fig, 1 tab, 18 ref.

Descriptors: *Phytoplankton, *Algae, *Chlorinated hydrocarbon pesticides, *Pesticide toxicity, Pesticides, Toxicity, Aroclors, Polychlorinated biphenyls, Diatoms, Growth rates, Cytological studies, Chlorophyta, *TCE, *HCB, Trichloroethylene, Hexachlorobenzene.

The effects of TCE and HCB on marine phytoplankton are reported. Mixed laboratory cultures of an estuarine centric diatom, Thalassiosira pseudonana and a green alga, Dunaliella tertiolecta were used. Neither TCE nor HCB inhibited algal growth at 50 or 100 micrograms/L. While cultures were growing exponentially, cell size distribution did not differ significantly from controls. Even when TCE or HCB were added daily at concentrations of 50 or 100 micrograms/L, the cell size distribution did not differ significantly from controls. It was concluded that the much lower naturally-occurring levels of these pesticides would have no effect on algal growth or alter species succession within natural phytoplankton assemblages. (Deal-EIS)
W79-04318

THE INFLUENCE OF SALINITY ON TOXICITY OF CADMIUM AND CHROMIUM TO THE BLUE CRAB, CALLINECTES SAPIDUS,
Kelly High School Beaumont, TX.
P. M. Frank, and P. B. Robertson.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 74-78, 1979. 2 fig, 1 tab, 16 ref.

Descriptors: *Toxicity, *Cadmium, *Chromium, *Crabs, *Salinity, Mortality, Bioassay, Heavy metals, Industrial wastes, Chemical wastes, Chemical analysis, Salts, Path of pollutants, Animal physiology, Water chemistry, Water analysis, Juvenile growth stage, Commercial shellfish.

This study reports the lethal concentrations of cadmium and chromium to juvenile blue crabs in acute toxicity tests at three different salinities. The 24, 48, 72 and 96-hr LC50 was determined for exposure to cadmium and chromium at salinities of 1, 15, and 35 ppt. As expected, cadmium was much more toxic than chromium at all salinities. Toxicity of both metals decreased with increasing salinity. The limitations of acute toxicity tests were also discussed. (Deal-EIS)
W79-04319

EFFECT OF PCBS AND OTHER ORGANOCHLORINE COMPOUNDS ON THE HATCHABILITY OF ATLANTIC SALMON (SALMO SALAR) EGGS,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
V. Zitko, and R. L. Saunders.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 125-130, 1979. 2 fig, 2 tab, 7 ref.

Descriptors: *Pesticide residues, *Fish eggs, *Atlantic salmon, Polychlorinated biphenyls, Chlorinated hydrocarbon pesticides, *DDT, *DDD, DDE, Pesticide toxicity, Chemical analysis, Fertility, Mortality, Fish physiology, Path of pollutants, *Chlordane, *Hexachlorobenzene, *Tissue analysis, *Bioaccumulation.

This paper reports changes in recent years in the levels of PCB's, hexachlorobenzene, and several organochlorine pesticides in Atlantic salmon eggs and the associated effects on hatchability and survival. The levels of PCB's and DDE were lower in 1975 and 1976 than those reported for 1971 while the levels of DDT and DDD remained practically constant. Recent samples also contained increased levels of hexachlorobenzene and for the first time, detectable levels of chlordane. No apparent correlations between levels of organochlorine compounds and hatchabilities were noted in the four salmon stocks studied. (Deal-EIS)
W79-04320

THE ACCUMULATION AND ELIMINATION OF DIFLUBENZURON BY FISH,
California Univ., Fresno. Mosquito Control Research Lab.
C. H. Schaefer, E. F. Dupras, Jr, R. J. Stewart, L. W. Davidson, and A. E. Colwell.
Bulleting of Environmental Contamination and Toxicology, Vol. 21, p 249-254, 1979. 3 tab, 10 ref.

Descriptors: *Insecticides, *Pesticide kinetics, *Sunfishes, Path of pollutants, Pesticide residues, Chlorinated hydrocarbon pesticides, Fish physiology, Animal metabolism, Chromatography, Chemical analysis, Chemical properties, Enzymes, Proteins, Biochemistry, DDT, Biodegradation, *Diflubenzuron, *Tissue analysis, *Bioaccumulation.

Diflubenzuron is accumulated from water into fish tissues at levels up to 80 fold within 24 hr when fish are exposed to concentrations of 10 ppb. Within the concentration range of 1-10 ppb, the amount accumulated in a 24 hr exposure is proportional to concentration. After 24 to 48 hr exposure fish degrade and eliminate diflubenzuron. The excretory products are neither the parent compound nor p-chloro-phenylurea. The amount of diflubenzuron remaining in fish tissues with time is dependent on the reduction of residue concentration in water; however, the potential for degradation and eliminations is very great. (Deal-EIS)
W79-04321

BIOMAGNIFICATION OF HEAVY METALS BY ORGANISMS IN A MARINE MICROCOSM,
Texas Univ. Health Science Center at Houston. School of Public Health.
For primary bibliographic entry see Field 5B.
W79-04322

ACUTE TOXICITY OF THE WATER-SOLUBLE FRACTION OF COOK INLET CRUDE OIL TO THE MANILA CLAM,
California Univ., Bodega Bay. Bodega Marine Lab.
P. Nunes, and P. E. Benville, Jr.
Marine Pollution Bulletin, Vol. 9, p 324-331, 1978. 4 fig, 5 tab, 4 ref.

Descriptors: *Toxicity, *Oil, *Clams, Methodology, Bioassay, Oil spills, Oil pollution, Organic compounds, Solubility, Mortality, Animal behavior, Animal physiology, Animal metabolism, Bioassay, Analytical techniques, Laboratory equipment, *Crude oil, Manila clam.

Recognition of the inherent complexities of oil bioassays prompted the development of several apparatuses designed to deliver uniform solutions of the water-soluble components of crude oil and capable of system equilibration for both static and continuous-flow bioassays without the loss of the more volatile compounds and without the formation of emulsions. Clams from a relatively contaminated area exhibited greater resistance to the water-soluble fraction of Cook Inlet crude oil than specimens from a more pristine area. Behaviour was altered below lethal levels suggesting the possibility of using behavioural modifications as a concommitant criterion of toxicity with mortality. An increase in mortality with a longer exposure period and a significant rate of latent mortalities following the end of the 96-h exposure period suggest that future bioassays with bivalves should be determined over a longer exposure period. (Deal-EIS)
W79-04323

THE PETROLEUM-INDUCIBLE MIXED-FUNCTION OXIDASE OF CUNNER (TAUTOGOLABRUS ADSPERSUS WALBAUM 1792): SOME CHARACTERISTICS RELEVANT TO HYDROCARBON MONITORING,
Memorial Univ. of Newfoundland, St. John's. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W79-04324

SWIMMING SPEEDS OF OYSTER LARVAE CRASSOSTREA VIRGINICA IN DIFFERENT SALINITIES AND TEMPERATURES,
New Jersey Oyster Research Lab., New Brunswick.
For primary bibliographic entry see Field 5A.
W79-04325

INCREASE IN THE HUMAN BLOOD PCB LEVELS PROMPTLY FOLLOWING INGESTION OF FISH CONTAINING PCBS,
Osaka Prefecture Inst. of Public Health (Japan). Lab. of Food Chemistry.
For primary bibliographic entry see Field 5B.
W79-04326

SPECTROPHOTOMETRICALY ASSAYED INHIBITORY EFFECTS OF MERCURIC COMPOUNDS ON ANABAENA FLOS-AQUAE AND ANACYSTIS NIDULANS (CYANOPHYCEAE),
New Orleans Univ., LA. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W79-04327

ELUTRIATE-PRIMARY PRODUCTIVITY BIOASSAYS OF DREDGE SPOIL DISPOSAL IN LAKE ERIE,
State Univ. of New York Coll. at Buffalo. Great Lakes Lab.
For primary bibliographic entry see Field 5B.
W79-04329

OCCURRENCE OF TOXIC BIVALVES IN ASSOCIATION WITH GONYAULAX PLANKTONS IN ISE, OWASE, AND OFUNATO BAYS,
Tokyo Univ. (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 5B.
W79-04331

EFFICIENCY OF CANAL BIODEGRADATION OF PALM OIL SLUDGE AND ITS POLLUTION EFFECTS,
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajihayat.
For primary bibliographic entry see Field 5D.
W79-04332

IN VIVO EFFECT OF ENDRIN ON THREE PHOSPHATASES IN KIDNEY AND LIVER OF THE FISH OPHIOCEPHALUS PUNCTATUS,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and S. K. Sharma.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 185-189, 1979. 1 tab, 18 ref.

Descriptors: *Enzymes, *Endrin, *Pesticide toxicity, Chlorinated hydrocarbon pesticides, Pesticide residues, Pesticide kinetics, Chemical properties, Chemical analysis, Fish physiology, Animal metabolism, Biochemistry, Proteins, *Ophiocephalus, *Tissue analysis.

The effect of endrin (0.030 ppm) on the acid phosphatase, alkaline phosphatase and glucose-6-phosphatase activities in the kidney and liver of a teleost fish, Ophiocephalus (Channa) punctatus has been studied. The period of exposure was twenty days. An increase in the acid phosphatase activity was noted in the two tissues examined. There was no significant change in the activity of alkaline phosphatase in kidney while in liver the enzyme was inhibited. In the kidney glucose-6-phosphatase showed a slight increase in activity but it was inhibited in liver. (Deal-EIS)
W79-04333

BEHAVIOR OF MERCURY IN BIOSYSTEMS. III. BIOTRANSFERENCE OF MERCURY THROUGH FOOD CHAINS,
Georgia Univ., Athens. Dept. of Food Science.
For primary bibliographic entry see Field 5B.
W79-04334

METHYLATED MERCURY IN BROOK TROUT (SALVELINUS FONTINALIS): ABSENCE OF AN IN VIVO METHYLATING PROCESS,
Oak Ridge National Lab., TN.
For primary bibliographic entry see Field 5B.
W79-04335

GROWTH OF FISHES DURING OLIGO-, MESO, AND EUTROPHIC STATUS OF LAKE CONSTANCE (FISCHWACHSTUM BEI OLIGO-, MESO- UND EUTROPHIE DES BODENSEES),
Staatliches Inst. fuer Seenforschung und Fischereiwesen, Langenargen (Germany, F.R.).
V. J. Hartmann.
Schweizerische Zeitschrift fur Hydrologie, Vol. 40, No. 1, p 32-39, 1978. 3 fig, 2 tab, 21 ref. (In German with English Abstract).

Descriptors: *Freshwater fish, Lakes, *Lake Constance, *Eutrophication, Oligotrophy, Mesotrophy, Fish diets, *Fish growth, Fish food organisms, Fish populations, Growth rates, Whitefish, Switzerland.

Recent growth of 14 fish taxa of Lake Constance has been studied. In the mesotrophic basin summer-pelagic species opposite to the others appears to grow faster now than during earlier oligotrophic status. From trends of growth, feeding and yield (table) it is concluded that eutrophication has favoured planktivores. In the eutrophic lower basin only coregonids grown slower than in the mesotrophic part of the lake. Factors that have caused growth differences are thought to be food density and water temperature (through chaned fish distribution and different shape of basin). (Katz-EIS)
W79-04336

THE RELATIVE CONTRIBUTIONS OF METHYLMERCURY FROM FOOD OR WATER TO RAINBOW TROUT (SALMO GAIRDNERD) IN A CONTROLLED LABORATORY ENVIRONMENT,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5B.
W79-04337

LEVELS OF BLOOD GLUCOSE AND TISSUE GLYCOGEN IN TWO LIVE FISH EXPOSED TO INDUSTRIAL EFFLUENT,
Centra Fisheries Extension Training Center, Hyderbad (India).
For primary bibliographic entry see Field 5A.
W79-04338

TOXICITIES OF CADMIUM, COPPER, AND ZINC TO FOUR JUVENILE STAGES OF CHINOOK SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
G. A. Chapman.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 841-847, 1978. 5 tab, 19 ref.

Descriptors: *Toxicity, *Cadmium, *Copper, *Zinc, Rainbow trout, Chinook salmon, Bioassay,

Group 5C—Effects Of Pollution

Growth stages, Juvenile growth stage, Fry, Smolt, Resistance, Heavy metals, Water chemistry, Salmonids, Fish physiology, Spectrophotometry, *Parr, *Tissue analysis, *Bioaccumulation.

Continuous-flow toxicity tests were conducted to determine the relative tolerances of newly hatched alevins, swim-up alevins, parr, and smolts of chinook salmon (Oncorhynchus tshawytscha) and steelhead (Salmo gairdneri) to cadmium, copper, and zinc. Newly hatched alevins were much more tolerant to cadmium and, to a lesser extent, to zinc than were later juvenile forms. However, the later progression from swim-up alevin, through parr, to smolt was accompanied by a slight increase in metal tolerance. The 96-h LC50 values for all four life stages ranged from 1.0 to > 27 micrograms Cd/liter, 17 to 38 micrograms Cu/liter and 93 to 815 micrograms Zn/liter. Steelhead were consistently more sensitive to these metals than were chinook salmon. When a sensitive life stage for acute toxicity tests with metals is sought, the more resistant newly hatched alevins should be avoided. Although tolerance may increase with age, all later juvenile life stages are more sensitive and should give similar results. (Deal-EIS)
W79-04339

ACUTELY LETHAL LEVELS OF CADMIUM, COPPER, AND ZINC TO ADULT MALE COHO SALMON AND STEELHEAD,
Corvallis Environmental Research Lab., OR. Western Fish Toxicology Station.
G. A. Chapman, and D. G. Stevens.
Transactions of the American Fisheries Society, Vol. 107, No. 6, p 837-840, 1978. 1 tab, 12 ref.

Descriptors: *Mortality, *Copper, *Cadmium, *Zinc, Lethal limit, Rainbow trout, Sockeye salmon, Toxicity, Heavy metals, Fish physiology, Hardness(Water), Alkalinity, Water chemistry, Growth stages, Chemical analysis, Fish reproduction, Spawning, Water pollution effects.

Flow-through acute toxicity tests of cadmium, copper, and zinc were conducted with adult male coho salmon (Oncorhynchus kisutch) and adult male steelhead (Salmo gairdneri). The 96-h LC50 values for copper were 46 and 57 micro g/liter, and for zinc were 905 and 1,755 micro g/liter, for coho salmon and steelhead, respectively. Mortality induced by cadmium was slow in onset, but 50% mortality occurred after more than a week at 3.7 micro g/liter for coho salmon and 5.2 micro g/liter for steelhead. Hardness and alkalinity of the water supply were higher during the toxicity tests with steelhead, complicating direct comparisons between the two species. (Deal-EIS)
W79-04340

TOXICITY OF TEXTILE WASTE TO SOME TELEOST FISHES,
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, A. K. Tyagi, and R. C. Dalela.
Water, Air and Soil pollution, Vol. 10, No. 3, p 351-358, 1978. 4 tab, 15 ref.

Descriptors: *Toxicity, *Industrial wastes, *Bleaching wastes, Chemical wastes, Bioassay, Textiles, Waste water, Mortality, Freshwater fish, Fish behavior, Fish physiology, Animal metabolism, Alkalis(Bases), Water quality standards, Fish diseases, Animal pathology, Suspended solids, Hydrogen ion concentration, *Tissue analysis, Textile wastes.

LC50 values for different periods, acute toxicity ranges and presumable harmless concentrations, along with relative susceptibility of a few freshwater teleost fish to textile waste have been determined. The presumable harmless concentration to regulate the disposal of this waste was 1.1254, 0.4966, 0.9912, 1.0157, and 1.086% by volume for fish, Saccobranchus fossils, Labeo rohita, Notopterus notopterus, Colisa fasiatus, and Ophiocephalus punctatus, respectively. (Deal-EIS)
W79-04341

THE ACUTE TOXICITY OF COPPER TO GAMMARUS FASCIATUS SAY, A FRESHWATE AMPHIPOD,
Colorado State Univ., Ft. Collins.
R. D. Judy, Jr.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 219-221, 1979. 3 fig, 1 tab, 6 ref.

Descriptors: *Copper, *Toxicity, *Amphipoda, Bioassay, Rainbow trout, Food webs, Fish food organisms, Metals, Copper sulfate, Mortality, Laboratory tests, Water chemistry, Laboratory tests, Laboratory animals, *Gammarus.

The results of a 48 hr acute bioassay for copper were significant. The response of G. fasciatus to copper was reproducible. The results of the tests are also significant when compared with published values for rainbow trout. It is suggested that these organisms could be used as the experimental organisms of importance in areas where they are found in abundance. (Deal-EIS)
W79-04342

THE EFFECT OF TEMPERATURE ON COPPER TOLERANCE OF PARAMECIUM,
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
C. Szeto, and D. Nyberg.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 131-135, 1979. 2 tab, 9 ref.

Descriptors: *Copper, *Toxicity, *Protozoa, *Water temperature, Seasonal, Heavy metals, Animal physiology, Resistance, Mortality, Copper sulfate, Chemical properties, Chemical analysis, Water chemistry, *Paramecium.

The copper tolerance of Paramecium tetrayrelia linearly decreases with increasing temperatures over the range of 12C to 34C. These results indicate that copper toxicity to at least some organisms can be considerably modified by other environmental parameters. For example, the same concentration of copper that produced no mortality in winter could be toxic in the summer. (Deal-EIS)
W79-04343

ARSENIC ACCUMULATION, TISSUE DISTRIBUTION AND CYTO-TOXICITY IN TELEOSTS FOLLOWING INDIRECT AQUEOUS EXPOSURES,
Texas Univ. at Austin. Dept. of Zoology.
E. M. B. Sorensen, R. E. Henry, and R. Ramirez-Mitchell.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 162-169, 1979. 2 fig, 1 tab, 15 ref.

Descriptors: *Toxicity, *Fish physiology, *Arsenic compounds, *Sunfishes, Microscopy, Cytological studies, Chemical analysis, Path of pollutants, Teleosts, Bioassay, Neutron activation analysis, Animal metabolism, *Arsenic, *Tissue analysis, *Bioaccumulation.

Fish were exposed to arsenic under controlled experimental conditions and sacrificed at specific intervals for measurement of progressive arsenic concentration within various critical organs. The gall bladder and bile accumulated the highest concentrations of arsenic during the 6-day exposure interval. Levels increased from about 35 to 78 to 159 ppm during the 2, 4, and 6-day exposures, respectively. Liver, spleen and kidney also accumulated significant amounts of arsenic. Cellular alterations as observed under light microscopy are described. (Deal-EIS)
W79-04344

ALTERATION IN THE ACTIVITIES OF THREE PEPTIDASES AND LIPASE IN THE DIGESTIVE SYSTEM OF THE FISH CHANNA PUNCTATUS EXPOSED TO LEAD NITRATE,
D. A. V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and P. K. Gupta.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, p 190-195, 1979. 2 tab, 16 ref.

Descriptors: *Lead, *Toxicity, *Enzymes, Nitrates, Heavy metals, Biochemistry, Proteins, Chemical reactions, Chemical analysis, Animal metabolism, Fish physiology, Bioassay, *Channa, *Tissue analysis.

The effect of exposure of Channa punctatus to LC(50) (6.8 mg/L) and sublethal concentration (2.8 mg/L) of lead nitrate on the activities of amino tripeptidase, glycyglycine, leucyl-l-glycine dipeptidases and lipase has been investigated. An inhibition in the activities of al the enzymes was noted after 96 hr, 15 and 30 days of treatment period. The inhibition in lipase activity was statistically insignificant in both the acute and chronic treatment cases. The experiments indicated that lead induced toxicity was more severe in chronic treatment as compared to acute treatment. (Deal-EIS)
W79-04345

CORPORATE COMPLIANCE AND COMPENSATION PROBLEMS IN ENVIRONMENTAL PROTECTION: IMPLICATIONS OF UNITED STATES V. RESERVE MINING COMPANY,
For primary bibliographic entry see Field 5G.
W79-04431

FLOATING NUCLEAR PLANTS - A 'REASONABLE USE' OF THE HIGH SEAS,
For primary bibliographic entry see Field 6E.
W79-04436

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

CARBONATE HYDROGEOLOGIC ENVIRONMENTS: THEIR RELATIONSHIP TO LAND USE, WATER RESOURCES DEVELOPMENT AND MANAGEMENT,
The Pennsylvania State Univ., University Park. Dept. of Geoscience.
For primary bibliographic entry see Field 4B.
W79-04494

5D. Waste Treatment Processes

THE EFFECTS OF ALUM SLUDGE ON PRIMARY SEDIMENTATION AND ANAEROBIC DIGESTION,
Auburn University, AL. Dept. of Civil Engineering.
B. A. Rindt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 709, Price codes: A06 in paper copy, A01 in microfiche. Ms Thesis, August 24, 1973. 109 p, 13 fig, 3 tab, 49 ref, 5 append. OWRT A-040-ALA(2).

Descriptors: *Sewage treatment, *Water pollution sources, *Alum sludge, *Anaerobic digestion, *Sedimentation, Sludge disposal, Water treatment, Coagulation, Methane bacteria, Biological treatment, Investigations, Laboratory tests, Anaerobic bacteria, Biochemical oxygen demand, Activated sludge, Sewage systems.

A study investigating the feasibility of disposing alum sludge to sanitary sewers is reported. Since primary clarification and anaerobic digestion are the two sewage treatment processes most likely to be affected by alum sludge disposal, their physical and chemical responses to alum sludge were examined. The experimental investigation involved the

use of a laboratory-created sludge and a sludge collected from the Auburn, Alabama, water treatment plant to study sedimentation with respect to settling time and sludge dosage; the effects of alum sludge on the operation of laboratory scale anaerobic digesters was studied. The investigation resulted in nine specific conclusions concerning the primary sedimentation process, and seven specific conclusions for anaerobic digestion. It is generally concluded that disposal of alum sludge to sewers is feasible, and sometimes beneficial, if domestic waste water treatment plants are capable of handling increased hydraulic and biological loads, and that the alum sludge be discharged to the sewers on a continuous flow basis during peak biological loading. (Davison-IPA)
W79-04001

A BASIS FOR AERATION DESIGN,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. S. Hunter, III.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 718, Price codes: A11 in paper copy, A01 in microfiche. Doctoral Dissertation, 1977. 242 p, 32 fig, 17 tab, 114 ref, 10 append. OWRT A-008-COLO (2).

Descriptors: *Waste water treatment, *Activated sludge, *Aeration, Mass transfer, Oxygen, Mathematical models, Equations, Investigations, Laboratory tests, Interfaces, Biological treatment, Sludge treatment.

Research undertaken to initiate steps toward developing a unified aeration design concept by identifying a measurable parameter or group of parameters that could be used to describe oxygen mass transfer across a gas-liquid interface is reported. An examination of the gas-liquid mass transfer theory and a literature search indicated that temporal mean velocity gradient G might serve as the parameter being sought. The development of an empirical equation for expressing oxygen mass transfer as a function of G for any one type of aeration system would strongly support hypothesis that a general relationship for predicting oxygen mass transfer exists. These studies show that oxygen mass transfer rate for laboratory-scale submerged turbine aeration systems can be expressed as a function of G. (Davison-IPA)
W79-04002

VIABILITY MEASUREMENTS ON ACTIVATED SLUDGE,
Alabama Univ. in Birmingham. Dept. of Biology.
J. E. Russell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 805, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, 1978. 91 p, 13 fig, 18 tab, 68 ref. OWRT A-060-ALAB(2).

Descriptors: *Measurements, *Viability, *Activated sludge, Waste treatment, Effluents, Industrial wastes, Municipal wastes, Biodegradation, Sludge treatment, Phenol, Laboratory tests, Monitoring.

A study to determine cell viability in industrial and municipal sludges is reported. Viability measurements incorporated into routine monitoring of an industrial activated sludge plant included: (1) fluorescence microscopy, (2) viable plate counts, (3) assay of ATP levels, and (4) endrogenous and substrate stimulated oxygen consumption. The standard monitoring techniques used included MLVSS. All measurements were correlated with effluent water quality. The effluent water quality at the municipal plant was measured as Biological Oxygen Demand, and that at the industrial plant was measured by monitoring concentrations of certain chemicals in the waste water. Variations of several parameters were compared relative to MLSS over the entire study period. ATP and fluorescence microscopy measurements correlated with each other, and varied over a broader range suggesting probable variations in the physiological state of the microbes. Plate count data yielded a much lower number of viable cells than other methods and varied over a wider range. Preliminary work done with oxygen consumption in the presence of phenol demonstrated a significant response to this substrate. This type of procedure furnishes a tool for investigating individual types of organisms within a population. This study established a base line for control of chemostat-pilot plant experiments. (Davison-IPA)
W79-04006

BACTERIAL METABOLISM OF ARYLSULFONATES: ROLE OF META CLEAVAGE IN BENZENE SULFONATE OXIDATION BY PSEUDOMONAS TESTOSTERONI,
Maryland Univ., College Park. Dept. of Microbiology.
M. J. Ripin, T. M. Cook, K. F. Noon, and L. E. Stark.
Applied Microbiology, Vol. 29, No. 3, p 382-387, March 1975. 5 fig, 5 tab, 14 ref. OWRT A-009-MD(2).

Descriptors: *Water pollution sources, *Microorganisms, *Bacteria, Industrial wastes, Chemical waste, Laboratory tests, Oxidation, Waste water treatment, Biodegradation, Biological treatment, Chemical reactions, Metabolism.

The oxidation of arylsulfonates by pseudomonas testosteroni is reported. Arylsulfonates are intermediates and byproducts in industrial chemical processes frequently found in industrial waste waters. Pseudomonas testosteroni H-8 oxidized some lower alkylbenzene sulfonates at rates inversely related to the length of the alkyl group. Some arylsulfonates produced 40 to 50% inhibition of oxygen uptake with benzene sulfonate (BS), and almost complete inhibition (97%) was shown with butylbenzene sulfonate. Oxidation of catechol was rapid and without lag for cells grown on BS. Accumulation of yellow meta cleavage products was shown when cells grown in BS were exposed to catechol, ethylbenzene sulfate (EBS) and propylbenzene sulfate (PS). No color developed with BS and TS. It was found that PS inhibited growth and respiration on BS; oxidation of glutamate was unaffected. It is suggested that the formation of the meta cleavage product from PS and the inhibition of catechol oxidation by PS may not be due to the PS, but to a metabolite. (Davison-IPA)
W79-04013

CLADOCERAN SURVIVAL STUDIES IN A KRAFT PULP MILL AERATED STABILIZATION BASIN,
K. K. Chew, and K. E. Norman.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 886, Price codes: A04 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University, Pullman. Completion report, December 16, 1978. 47 p, 12 fig, 2 tab, 44 ref. OWRT-A-093-WASH(2).

Descriptors: *Zooplankton, *Moina macrocopa, *Water pollution control, *Pulp wastes, Laboratory tests, Sampling, Aquatic populations, Biochemical oxygen demand, Water quality, Water analysis, Settling basins, Waste treatment, Water pollution sources, Aerated lagoons, Biological treatment.

The cladoceran stocks in the Weyerhaeuser settling pond in Everett, Washington, were examined over the year regarding the spatial, temporal, and abundance of M. macrocopa. In determining whether physical factors could be correlated with the presence or absence of M. macrocopa, the following water quality parameters were considered; biochemical oxygen demand (BOD), total suspended solids (TSS), pH, temperature, dissolved oxygen (DO), and sunlight/day. Field sampling and laboratory studies were conducted to test the use of M. macrocopa for enhancement of waste treatment, and to investigate the potential for controlling these zooplankton population levels by nutrient manipulation. The potential use of M. macrocopa as a marketable fish food was studied. It was found that the distribution of these animals is seasonal and uneven through the lagoon. Temperature and sunlight did not account for a large part of the population flux. It is thought that nutrient depletions during bloom conditions were responsible for the population flux. M. macrocopa removed TSS by ingestion and had a significant beneficial impact on water quality through aiding waste abatement. Their potential as a fish food was demonstrated in the laboratory. (Davison-IPA).
W79-04111

MODEL STUDIES ON THE EFFECTS OF ALUM SLUDGE ON THE ACTIVATED SLUDGE WASTE TREATMENT PROCESS,
Auburn Univ., AL.
J. R. Voorhees.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 891, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, December 11, 1974. 108 p, 24 fig, 13 tab, 33 ref, 2 append. OWRT-A-040-ALA(4).

Descriptors: *Alum sludge, *Waste water treatment, *Sewage treatment, *Activated sludge, Municipal wastes, Phosphates, Nitrification, Water purification, Laboratory tests, Sewage systems, Chemical oxygen demand, Adsorption, Neutralization.

The impact of releasing alum sludge, generated by water purification processes, to sanitary sewer systems is reported. Phase I of the three phase investigation is concerned with the start-up and routine feeding of the eight reactors used. Phase II included the procedures used when a laboratory-prepared aluminum hydroxide sludge was fed to four of the reactors. Phase II involved the procedures used when alum sludge, collected from the Auburn, Alabama, water treatment plant was added to three of the remaining reactors. Laboratory prepared alum sludge fed to the reactors containing activated sludge showed no adverse effects on COD and TOC removal, and did not affect the nitrification process. The alum sludge greatly improved phosphate removal. Alum sludge, introduced as one shock load to the reactors containing the water treatment plant sludge, resulted in severe, temporary decrease in COD and TOC removal; the system recovered and removals increased. The nitrification process and phosphate removal were not affected. (Davison-IPA)
W79-04114

THE EFFECTS OF ALUM SLUDGE ON ANAEROBIC DIGESTION,
Auburn Univ., AL.
R. C. Reed.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 890, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, March 18, 1975. 82 p, 7 fig, 16 tab, 30 ref, 2 append. OWRT-A-040-ALA(3).

Descriptors: *Sewage treatment, *Water pollution sources, *Alum sludge, Anaerobic digestion, Water treatment, Methane bacteria, Biological treatment, Anaerobic bacteria, Biochemical oxidation demand, Activated sludge, Sludge disposal, Laboratory tests.

Research on the effects of alum sludge on the process of anaerobic digestion is reported. Working anaerobic sludge from an Auburn sewage treatment plant was used as seed sludge in four laboratory scale anaerobic digestors. The procedure employed simulated a completely-mixed, continuous-flow, no-recycle anaerobic digestion system. Routine analyses were performed on the feed and digesting sludges. Test samples containing very low suspended solids were required for total carbon, total inorganic carbon, volatile acids, nitrates, nitrites, and biochemical oxygen demand (BOD) and COD for digesting sludge. Within six days of the introduction of modified feed sludge, digestors A and D showed signs of failure. It was concluded that this failure was due to the inhibition of methane-forming bacteria, as volatile acid concentration continued to increase. Methane bacteria were not significantly inhibited by the aluminum ion in digester C, suggesting another cause of toxicity. It was hypothesized that the sulfide in the sludge inhibited the methane bacteria. Water treat-

ment plant sludge decreased COD and phosphate levels in the digesting sludge supernatant; TOC and BOD were basically unaffected. Alkalinity and pH decreased for the digesting sludge. (Davison-IPA)
W79-04115

EFFECTS OF ALUM WATER TREATMENT SLUDGE ON DOMESTIC WASTEWATER SLUDGES,
Auburn Univ., AL.
M. E. Burman, III.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 889, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, December 10, 1975. 105 p, 6 fig, 24 tab, 36 ref, 1 append. OWRT-A-040-ALA(5).

Descriptors: *Waste treatment, *Alum sludge, *Activated sludge, *Sewage treatment, Sewage sludge, Sludge treatment, Municipal wastes, Waste treatment, Filtration, Aerobic treatment, Laboratory tests, Sewage, Phosphates.

Research on the effects of alum sludge generated by water treatment plants on the properties of domestic waste water sludges is reported. Phase I of the three phase investigation was concerned with the effects of raw sewage containing alum sludge on an activated sludge batch process. Phase II investigated the effects of alum sludge on waste activated sludge undergoing aerobic digestion. Phase III involved a series of filtrations performed on primary sewage sludge-alum sludge mixtures. The presence of alum sludge in raw sewage decreased raw primary sludge specific resistance, but did not affect the specific resistance of the activated sludge used in treating that sewage. An increase in specific resistance of waste activated sludge containing alum sludge was shown at the beginning of the digestion period. Phosphate analysis, performed on waste activated sludge filtration during digestion, showed that alum sludge effectively removed phosphates from the filtrate. Results of the series of filtrations indicated that specific resistance decreases and sludge compressibility increases when alum sludge is mixed with primary sewage sludge. (Davison-IPA)
W79-04116

WASTEWATER TREATMENT FOR SMALL RURAL COMMUNITIES,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
C. E. Parker.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 904, Price codes: A02 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Virginia Polytechnic Institute and State University, Blacksburg. Completion report, 1973. 15 p, 2 fig, 2 tab, 10 ref. OWRT-A-052-VA(1).

Descriptors: Algae, *Waste water treatment, *Waste storage, *Oxidation lagoons, Dissolved oxygen, Rural communities, *Aeration.

A laboratory study using algal growth units was used to determine the parameter responsible for flotation of algal cells coagulated with aluminum sulfate. The effect of mixing was also studied and these results were used to evaluate process design for chemically treated lagoon effluent. In addition, cost comparisons between extended aeration with chemical-physical treatment and lagoon treatment followed by the chemical-physical treatment were made. Dissolved oxygen was found to be the parameter than can be used to control sedimentation under field operating conditions. By maintaining a lagoon effluent with dissolved oxygen less than 50% saturation, sedimentation can be assured. Mixing variations did not appreciably affect the ability to float, only the time required to produce flotation. Design parameters used in conventional water treatment plant design seem to be reasonable for designing algal coagulation, sedimentation, and filtration facilities. The use of lagoons followed by chemical-physical treatment is comparable economically to extended aeration treatment up to a population of 500. For populations up to 5000 lagoon-chemical-physical treatment will result in an initial cost burden 50% less than extended aeration followed by chemical-physical treatment. Therefore, where phosphorus and nitrogen reductions are desirable, lagoon-chemical-physical treatment offers a considerable economic advantage to the small community.
W79-04119

SURFACE-TREATED ACTIVATED CARBON FOR REMOVAL OF AMMONIA FROM WATER.
Pennsylvania State Univ., University Park, PA. Dept. of Material Sciences.
O. P. Mahajan, A. Youssef, and P. L. Walker, Jr.
Separation Science and Technology, Vol 13, No. 6, p 487-499, 1978. 4 tab. OWRT-A-043-PA(1), 14-34-0001-6039.

Descriptors: Following oxidation, pH values of aqueous carbon suspensions decrease appreciably with a concomitant increase in their ammonia absorption capacities. Oxidative treatment with nitric acid is most effective for enhancing ammonia adsorption capacity of a carbon. Irrespective of the oxidative treatment, the relative concentration of carboxylic, lactonic, and phenolic groups on different oxidized carbons is more or less constant. Breakthrough curves have been measured at different flow rates for two oxidized carbons. Bed capacities are essentially constant after the first cycle and could be regenerated with 0.1 N HCl. (Sink-Penn State)

As-received commercial activated carbons do not adsorb noticeable amounts of ammonia from aqueous solution.
W79-04132

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME I.
Camp, Dresser, and McKee, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 540, Price codes: A19 in paper copy, A01 in microfiche. Report to the North Central Texas Regional Planning Commission, July 1970. 13 sections, 36 fig, 73 p. See also Volume 2 - Appendix.

Descriptors: *Waste water treatment, *Waste water(Pollution), *Regional analysis, *Planning, *Treatment facilities, *Water supply, *Dallas(TX), *Fort Worth(TX), Texas, Waste water disposal, Water pollution, Water pollution treatment, Water demand, Water quality, Water reuse, Sewage treatment, Financing, Institutions, Administration, Cost analysis, Construction, Sewage disposal, Pollution control, Structural alternatives, Upper Trinity River Basin(TX).

The study's objective was the preparation of an area-wide comprehensive sewerage system and program both for interceptor and trunk sewers and for sewage treatment and disposal facilities in the North Central Texas region. Methods for plan implementation are suggested. The study area is about 11,000 square miles--larger and more populous than several states. Included are Dallas and Fort Worth and about 20% of the state's population. Six large joint use wastewater treatment plants are proposed in the Dallas-Fort Worth metropolitan area. The improved conveyance and treatment facilities are expected to raise associated costs threefold for residents. However, much of this burden is expected to be eased by federal and state grants. The report also recommends further study of problems such as agricultural runoff, storm runoff, septic tank use, infiltration into collection systems, and wastewater reuse. Specifically, reviewed in the report are water quality considerations, existing facilities, quantity and quality of sewage flow, design and costing criteria, costing estimates, alternative regional systems, the final recommended regional alternative and administration, and financing of the selected plan. (See also W79-04136) (Zayac-NC)
W79-04135

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME 2: APPENDIX.
Camp, Dresser, and McKee, Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 541, Price codes: A11 in paper copy, A01 in microfiche. Report to the North Central Texas Council of Governments, July 1970, second of two volumes. 237 p, Appendices A through 1.

Descriptors: *Wastewater treatment, *Industrial wastes, *Soil classification, *Linear programming, *Low-flow augmentation, *Dallas(TX), *Fort Worth(TX), *Wastewater treatment plants, *Questionnaires, *Trunk sewers, Wastewater(Pollution, Texas, Sewers, Water quality, Treatment facilities, Sewage disposal, Waste water treatment plant operators.

This volume contains 9 appendices to the Comprehensive Sewerage Plan for the Upper Trinity River Basin. The objective of the study, as set out in the main report, was to prepare an area-wide comprehensive sewerage system and program for the North Central Texas region. Appendix A presents Texas water quality requirements applicable to the Trinity River as abstracted from 'Water Quality Requirements: Volume 1, Inland Waters', published by the Texas Water Quality Board, June 1967 and 'Water Quality Standards Summary', September 1969. Appendices B and C are questionnaires for major wastewater treatment plant operators, and industrial waste dischargers, respectively. Appendix D presents information on existing trunk sewers in the study area. The sewers included are primarily those carrying sewage flows from one population center to another for treatment, or which convey flows for more than one community. Appendix E is a soils legend for the study area; Appendix F outlines linear programming procedures; and Appendix G reviews procedures for estimating low flow augmentation requirements. Appendix H is a glossary; Appendix I is a bibliography. (See also W79-04135) (Zayac-NC)
W79-04136

INVESTIGATION OF THE LONG-TERM EFFECTS OF CHLORINE ON THE OXYGEN DEMAND OF WASTEWATERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
J. C. Young, and C. D. McCallion.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 161, Price codes: A07 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Iowa State University, Completion Report, ISWRRI-88, September 1977. 129 p, 26 fig, 8 tab, 58 ref, 3 apend. OWRT A-060-IA(1).

Descriptors: *Chlorination, *Biochemica oxygen demand, *Nitrification, Oxygen sag, Oxygen demand.

Studies of the long-term effect of chlorination on wastewaters have shown that the effect primarily is to reduce the rate of biochemical oxidation of organic material rather than to oxidize the organics chemically. This reduction in rate gives the appearance of reducing the biochemical oxygen demand; but upon reseeding, as by mixing with river water, the full oxygen demand of the wastewater is exerted. Nitrification does not seem to begin in the presence of chlorine; but when the free and combined residual is dissipated, nitrification can occur and tends to proceed at a rate equal to that in unchlorinated samples. The research results indicate that chlorination of secondary effluents may delay nitrification in streams until the wastewater reaches a second discharge point downstream where the nitrogenous oxygen demand of both wastewaters may then be superimposed, essentially compounding the oxygen sag problems downstream of the second discharge point.
W79-04160

ESCANABA'S ENVIRONMENTAL SYSTEMS: THE FIRST FIVE YEARS,

Mead Paper Co., Escanaba, MI.
J. L. Parr.
PIMA (Paper Industry Management Association) Magazine, Vol. 60, No. 9, p 14-15, September, 1978. 1 illus.

Descriptors: *Pulp wastes, *Waste water treatment, Biological treatment, Waste, Industrial wastes, Water pollution sources, Water pollution treatment, Waste treatment, Pulp and paper industry, Effluents, Odor, Aerated lagoons, Oxygen, Nutrients, Aeration, Water conservation, Michigan, Sodium sulfate, Air pollution control, Kraft mills, Clarifiers.

Mead Paper Co.'s kraft mill at Escanaba, Michigan, has successfully eliminated saltcake emissions by the addition of low-energy wet scrubbers in series with the recovery boiler precipitator, and odor problems have been prevented during normal operations. Occasional odors are from the effluent treatment system. The 10-day treatment time is provided by two lagoons in series, and the first lagoon has been subject to occasional odor problems associated with oxygen depletion. This has been improved by changing the point of nutrient addition to the inlet of the second lagoon and by providing additional aeration in the first lagoon. Effluent from the lagoons flows to a secondary clarifier. The mill has continuously met all river quality criteria. A water conservation program is in progress with the goal of reducing water consumption by one-third, and effluent treatment improvement trials are being conducted. (Louden-IPC)
W79-04219

LIMITING THE COSTS OF POLLUTION CONTROL: TREATMENT OF EFFLUENTS AT THE SOURCE (LIMITATION DU COUT DE LA DEPOLLUTION: TRAITEMENT DES EFFLUENTS A LA SOURCE),
Institut National de Recherche Chimique Appliquee, Paris (France).
E. Jager-Forget.
Papier, Carton et Cellulose, Vol. 27, No. 7, p 44-46, July, 1978. 2 fig, 1 illus, 3 ref.

Descriptors: *Pulp wastes, *Waste water treatment, Wastes, Industrial wastes, Water pollution treatment, Waste treatment, Water pollution sources, Pulp and Paper industry, Effluents, Combined sewers, Separated sewers, Biochemical oxygen demand, Biological treatment, Water pollution control, Costs, Condensates, Black liquor.

A brief examination is presented of the advantage of a general treatment of mill effluents vs. those of separate treatment of different effluents in specialized stages. For instance, in a pulp mill in which the evaporator condensates represent 55% of the BOD load of the total effluents but only 1.5% of the volume, sparate biological pretreatment of these condensates can reduce overall pollution control costs significantly. Another example is cited in which a pulp mill has a general effluent with a volume of 8,750 cu m/day and a load of 8.75 tons/day as well as black liquors with a volume of 300 cu m/day and a load of 6.0 tons/day. Here, single-stage combined treatment would appear to be preferable. (Speckhard-IPC)
W79-04221

WHAT'S NEW IN FLOTATION. (QUOI DE NEUF EN FLOTTATION),
R. Besse.
Papier, Carton et Cellulose, Vol. 27, No. 7, p 42-43, July, 1978. 7 fig.

Descriptors: *Pulp wastes, *Waste water treatment, *Treatment facilities, *Flotation, Fiber recovery, Filler recovery, Pulp and paper industry, Effluents, Water pollution treatment, Water pollution sources.

A brief description is given of Krofta Engineering Corp.'s Supercell flotation unit for treatment of waste waters. The unit can be used, for example, in the recovery of papermaking fibers and fillers. (Speckhard-IPC)
W79-04224

THE REMOVAL OF COLOR FROM EFFLUENT USING VARIOUS ADSORBENTS: SOME PRELIMINARY ECONOMIC CONSIDERATIONS,
Queen's Univ., Belfast (Northern Ireland). Dept. of Industrial Chemistry.
G. McKay, M. S. Otterburn, and A. G. Sweeney.
Journal of the Society of Dyers and Colourists, Vol. 94, No. 8, p 357-360, August, 1978. 4 fig, 18 ref, 4 tab.

Descriptors: *Waste water treatment, *Decoloring, *Textiles, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Dyes, Carbon, Peat, Adsorption, Costs, Model studies, Economics, Clays, Silica, Color, Wood, Aluminum oxide.

A series of isotherms were used to study the adsorption of Telon Blue ANL (C.I. Acid Blue 25), Astrazone Blue FRR (C.I. Basic Blue 69), Chlorazol Sky Blue FFS (C.I. Direct Blue 1), and Cibacet Turquoise Blue G (C.I. Disperse Blue 7) on various adsorbents (carbon, fuller's earth, silica, wood, peat, and alumina). Experimental conditions were selected so that the isotherms reached a plateau and so that the saturation value of the adsorptive capacity (mg of dye adsorbed per g of adsorbent) could be determined. The values were used to assess the quantity of adsorbent required to remove 1 kg of dye. These quantities have been used as a basis for costing the adsorption process. The results indicate that carbon has the highest adsorptive capacity, but an economic model shows that peat and wood may also be used since they too have high adsorptive capacities while being much cheaper. (Witt-IPC)
W79-04253

TOXICITY REMOVED BY FOAM SEPARATION,
British Columbia Research Council, Vancouver.
K. S. Ng, L. A. Gutierrez, and J. C. Mueller.
Industrial Wastes, Vol. 24, No. 5, p 36-38, 40-41, September/October, 1978.

Descriptors: *Pulp wastes, *Waste water treatment, *Detoxification, *Foam separation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Effluents, Toxicity, Pilot plants, Canada, Aeration, Bubbles, Foaming, Nozzles, Turbines, Collapse, Equations, Foreign countries, Kraft mills, Bleached pulp mills, Pollution abatement.

The performance of foam separation in removing toxic substances from pulp mill effluents was studied in a 450 cu m/day (100,000 gal/day) pilot plant at two bleached kraft mills in British Columbia. Jet aerators were used for foam generation and turbines for foam breaking. The jet aerator consistently produced fine bubbles and generated sufficient gas-liquor interface for toxicity adsorption. Mean bubble size increased from 0.015 mm at 0.03 cu m/min of air load per jet and approached 1.2 mm at air loads exceeding 0.6 cu m/min. A 5-cm-diameter jet aerator operating at maximum design air load of 1.4 cu m/min (1.2 mm mean bubble size) was calculated to produce approximately 4,7-00 sq m/cu m air interfacial area. A 31-cm-diameter 3-blade vaned disk turbine effectively collapsed up to 1.4 cu m/min of foam. Foam breaking capacity and power consumption can be predicted by the two equations given. The minimal gas-liquid interfacial area necessary for detoxification of bleached kraft mill effluent was determined at 7 sq m/liter and 40 sq m/liter for the two mills. Detoxification success rates over prolonged operation time of a 3-stage system were 89 and 84%, respectively. (Witt-IPC)
W79-04254

PHYSICO-CHEMICAL TECHNIQUES FOR TREATING MILL EFFLUENTS: A STATE-OF-THE-ART REVIEW,
PPRIC, Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
A. Wong, and S. Prahacs.
Pulp and Paper Canada, Vol. 78, p 63-67, July, 1977. 2 fig, 6 tab, 28 ref.

Descriptors: *Pulp wastes, *Pulp and paper industry, *Adsorption, *Ion exchange, *Separation techniques, Coagulation, Flocculation, Chemical precipitation, Activated carbon, Biochemical oxygen demand, Industrial wastes, Color, Toxicity, Lime, Ozone, Waste water treatment, Effluents, Physical-chemical treatment.

Applications of physico-chemical treatment techniques for the reduction of toxicity, color, and BOD of bleached kraft mill effluents are discussed. The basic techniques used for pulp and paper mill effluents include adsorption, ion exchange, coagulation, flocculation, precipitation, adsorptive bubble, and membrane separation. Various methods for the detoxification of pulp and paper effluents are described. The PPRIC carbon treatment process includes the addition of powdered activated carbon, aeration, the addition of settling agents, and clarification. Granular carbon adsorption is based on the use of carbon-packed filter columns. Foam separation involves the adsorption of surface active toxicants on gas bubbles rising through the effluent. Lime treatment and chemical flocculation using alum with and without a polyelectrolyte are discussed. Decolorization processes are reviewed, including ultra-filtration, ozone, solids contact processes, ion exchange, and biological treatment. Current research on the use of physico-chemical treatment to reduce BOD is described. (Schulz-FIRL)
W79-04256

TERTIARY TREATMENT OF EFFLUENTS BY FILTRATION,
Schumacherschе Fabrik, Bietigheim (Germany, F.R.).
H. J. Schmidt-Holthausen.
Filtration and Separation, Vol. 15, No. 4, p 350, 352, 367, July/August, 1978. 1 fig, 1 tab.

Descriptors: *Waste water treatment, *Filtration, *Tertiary treatment, Waste treatment, Water purification, Water pollution control, Water pollution treatment, Industrial wastes, Wastes, Separation techniques, Filters, Effluents.

Following mechanical and biological treatments of effluents, a third or even fourth stage for further purification is now being used or considered in some areas, including industrial water pollution control. Filtration processes as 3rd- or 4th-stage methods are said to offer cost-effective performance. Two such processes are described in some detail, namely (1) filtration by a separating layer having pores smaller than the deposited particle diameter (including two-layer filter materials, quartz sand depth filters, etc.), and (2) percolating filtration (bottom-to-top flow, and combination upward/downward filtration). (Brown-IPC)
W79-04279

THE FILTER BELT PRESS -- APPLICATION AND DESIGN,
Simon-Hartley Ltd., Stoke on Trent (England).
E. P. Austin.
Filtration and Separation, Vol. 15, No. 4, p 320-322, 324, 326, 329-330, July/August, 1978. 5 fig, 2 illus, 1 tab.

Descriptors: *Presses, *Sludge treatment, *Dewatering, Wastes, Waste treatment, Water pollution treatment, Water pollution sources, Design, Polymers, Chemicals, Operation and maintenance, Sludge, Equipment, Belt presses.

Activity in the field of belt-press design has accelerated rapidly over the past 5 yr. The many designs currently available owe their existence to the availability of polymeric chemicals which promote release of free water from the solid phase. Most belt presses rely on the production of a sandwich of sludge between two mesh belts which is subsequently subjected to various forces to squeeze out the water. The layout of the roller trains through which the sandwich has to pass varies considerably

and, all other factors being equal (which is not the case), would appear to be the only distinguishing variable between probably 20 or more types of machines. Discussed are dewatering principles, stages in the operation of a belt press, and machinery design. (Louden-IPC)
W79-04286

ENSO-BIOX METHOD FOR DEODORIZATION AND DETOXIFICATION OF WASTE WATERS,
Enso-Gutzeit Osakeyhtio, Imatra (Finland).
J. Kreula, L. Silakoski, and A. Vesanto.
Empire State Paper Research Associates, Invited Papers Presented at the Spring Meeting, April 3-5, 1978, Mobile, Alabama, p 35-50. 5 fig, 4 ref, 3 tab. Empire State Paper Research Institute, Syracuse, New York.

Descriptors: *Pulp wastes, *Waste water treatment, *Biological treatment, Oxidation, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, Pulp and paper industry, Food processing industry, Effluents, Odors, Toxicity, Sulfur compounds, Microorganisms, Bark, Trickling filters, Filters, Solids contact processes, Yeasts, Poultry, Kraft mills, Detoxification, Condensates, Blood, Foreign countries, Europe, Finland.

A biofilter method developed from the pioneering work of O. Koistinen at Enso-Gutzeit Oy. in Finland oxidizes malodorous and/or toxic sulfur compounds through the action of microorganisms living on the bark filling of trickling filters. Historical, theoretical, and practical aspects of the process are outlined. Originally intended for treatment of kraft-mill condensates, the Enso-Biox process has been applied also to the purification of yeast factory effluents and of odiferous condensates from the hydrolysis of poultry feathers, blood, and other slaughterhouse residues used to make animal-fodder protein. The earliest full-scale commercial Biox installation started up in 1967 at the Uimaharji kraft mill, (Finland) which has a daily capacity of 350 metric tons of bleached kraft pine and birch pulp. Although market fluctuations caused several mill shutdowns even those occasioned during winter did not damage the biofilters which regained normal effectiveness within a few days after a restart. (Brown-IPC)
W79-04295

EXPERIENCE WITH THE OPERATION OF AN EFFLUENT CLARIFIER (EXPERIENCE D'OPERATION D'UN CLARIFICATEUR D'EFFLUENTS),
Price Co. Ltd., Alma (Quebec).
M. Langlois.
Canadian Pulp and Paper Association Summer Technology Conference, May 31-June 3, 1978, Pointe-Au-Pic, Quebec, Canada, Preprints, p F1-F5.

Descriptors: *Pulp wastes, *Waste water treatment, *Clarifiers, *Operation and maintenance, Water pollution treatment, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Waste treatment, Canada, Foreign countries, Sewage, Bearings, Sludge, Operating costs, Costs, Treatment facilities, Newsprint mills.

The effluent clarification system installed at the integrated newsprint mill of Price Co. at Alma, Quebec, is described, and operating experience is reviewed. Covered in particular are the difficulties caused by the presence of sewage in the clarifier and by the use of a metal riddle, means employed for reducing the wear of metal bearings, the possibility for removing sludge at low temperatures during a breakdown in the clarifier drive mechanism, and operating costs. (Speckhard-IPC)
W79-04305

THE EFFECT OF PETROCHEMICAL STRUCTURE ON METHANE FERMENTATION TOXICITY,
Drexel Univ., PA. Environmental Studies Inst.
For primary bibliographic entry see Field 5A.
W79-04315

EFFICIENCY OF CANAL BIODEGRADATION OF PALM OIL SLUDGE AND ITS POLLUTION EFFECTS,
Universiti Sains Malaysia, Penang. Pusat Pengajian Sains Kajihayat.
P. M. Sivalingam, and S. Thavaraj.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 44, No. 11, p 1229-1237, 1978. 13 fig, 3 tab, 16 ref.

Descriptors: *Biodegradation, *Chemical wastes, *Toxicity, *Waste treatment industrial wastes, Microbial degradation, Biochemical oxygen demand, Carp, Fish physiology, Productivity, Agricultural chemicals, Organic compounds, Bacteria, Biological treatment, Nitrogen, Proteins, *Palm oil.

An investigation on the efficiency of the irrigational biodegradation canal treatment of palm oil mill sludge indicated that there was practically no significant change in its BOD value. Its adverse effects on aquatic organisms such as Cyprinus carpio, Liza subviridis, and Anadara granosa demonstrated the seriousness of the problem. Microbial gas production studies and total microbial counts of the samples indicated activity and bacterial counts to be highest at stations nearest to the factory, excluding that within the premises of the factory proper. Productivity studies of the vegetation adjacent to the biodegradation canal indicated higher productivity at points nearer to the canal itself while productivity decreased progressively towards points farthest from it. This phenomenon is attributed to the large deposition of minerals from sludge into the soil, the lowering in soil pH values, and possibly osmotic capillary processes, resulting in the inhibition of the growth of each organism. Based on these results, it is evident that the problem of organic pollutants from sludge discharged from palm oil mills is yet to be tackled. An alternative treatment method of this agro-waste should be considered to protect the Malaysian aquatic environment from depletion of its protein resources in the very near future. (Deal-EIS)
W79-04332

ANALYSIS OF PRACTICABILITY OF A SOLUTION TO THE PROBLEM OF POLLUTION BY SPENT LIQUORS (ANALYSE DE PRACTICABILITE D'UNE SOLUTION AU PROBLEME DE LA POLLUTION PAR LES LIQUEURS RESIDUELLES),
Quebec Univ., Trois-Rivieres.
R. Rochette, R. Lakshmanan, S. Lakshminarayan, and R. L. Papineau.
Canadian Pulp and Paper Association Summer Technology Conference, May 31-June 3, 1978, Pointe-Au-Pic, Quebec, Canada, Preprints. p E1-E5. 1 fig, 11 ref, 4 tab.

Descriptors: *Pulp wastes, *Proteins, *Waste water treatment, Sulfite liquors, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Pulp and paper industry, Effluents, Costs, Economics, Feeds, Biomass, Water pollution control, Poultry, Return(Monetary), Sulfite pulp mills, Spent sulfite liquor.

Results are presented from a study on the practicability of industrially producing protein from spent sulfite pulping liquor. The animal feed industry constitutes the main outlet for the biomass produced which contains about 38% protein. The poultry industry alone has been able to absorb 66,000,000 lb/yr of biomass which corresponds to the treatment of spent sulfite liquor from the production of 1,800 tons of pulp/day. The costs of operating such an industrial process are estimated at about $16/ton of biomass, which is slightly above the price of soya meal. However, the effect of reducing the pollution-control efforts necessary at a sulfite pulp mill should be taken into account in evaluating the economics of protein production from spent pulping liquor. Data are presented indicating that a mill producing 200 tons of pulp/day could attain an annual level of return (before taxes) of 33% on the investment in a system for biomass production. (Speckhard-IPC)
W79-04400

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
H. T. Davis.
Environmental Science and Technology, Vol. 12, No. 3, p 276-83, March, 1978.

Descriptors: *Idaho, *Environmental effects, *Exploitation, *Evaluation, State governments, Water pollution sources, Water pollution treatment, Water quality control, Water quality, Streams, Rivers.

Point source pollution problems in Idaho are among the nation's most complex. As one of the last 'old west' states, Idaho faces the problem of unfettered exploitation rights advocated by its traditionally conservative citizens, and opposed by others more environmentally conscious. However, the state legislature is consistently anti-environmental, and has passed only two effective major environmental protection bills in the past six years. Federal agencies such as the Forest Service and Bureau of Land Management are active with environmental programs within the state, but other agencies, such as the Farmers Home Administration, have helped to create problems by funding residential subdivisions contributing to urban sprawl. While the federal Environmental Protection Agency has stated that Idaho's streams have most of the Pacific Northwest's water pollution, federal and state cleanup efforts have recently increased. Air quality is still generally good, but particulate and sulphur dioxide standards are often violated. Mining and smelting activities cause special problems, while logging and livestock adversely affect the ecosystem. Overall, cautious optimism for the future is justified, but progress will be slow. (Rule-Florida)
W79-04421

CITIZENS' COMMITTEE TO PRESERVE LAKE LOGAN V. WILLIAMS (STATE AGENCY'S MAINTENANCE OF WATER QUALITY THROUGH CONTROL OF EFFLUENTS FOUND TOO STRICT),
381 N.E. 2d 661-68 (Ohio Ct. App. 1977).

Descriptors: *Effluents, *Sewage treatment, *Water quality standards, *Ohio, Permits, Water pollution, Environmental effects, Technology, Lakes, Regulation, Discharge(Water), Surface waters.

The Ohio Environmental Board of Review (EBR) ordered the state Director of Environmental Protection to modify effluent limitations contained in a permit issued for the construction of a sewage treatment plant. The EPR order in effect modified the permit to the extent that any discharge of effluent could not degrade the water below the existing water quality of the receiving waters. The director appealed the order. Reversing the order, the appeals court held that the Review Board had erred in failing to make findings as to whether the technology used in the sewage treatment plant would provide the most effective treatment available under existing technology and as to whether discharge of effluents from the plant would be in compliance with general water quality standards and would not cause significant degradation of a nearby lake. The court stated that the proper test was that of 'significant degradation,' a standard lower than that required by the Review Board. After examining the applicable regulations, the Court decided that a matching of the water quality of the discharged water and the receiving waters was not to be required. (Hucks-Florida)
W79-04430

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

CESSATION OF RETURN FLOW AS A MEANS OF COMPLYING WITH POLLUTION CONTROL LAWS,
For primary bibliographic entry see Field 6E.
W79-04445

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

METHOD FOR THE PURIFICATION OF SEWAGE WATERS WHICH CONTAIN ORGANIC COMPOUNDS OF AN ANIONIC NATURE,
Anic, S.p.A., Palermo (Italy). (Assignee).
R. Fusco.
U.S. Patent No. 4,120,789, 5 p, 2 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 975, No 3, p 1101, October 17, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Industrial wastes, Organic wastes, Water pollution treatment, Chemical precipitation, Dyes, Separation techniques.

The purification of sewage waters containing simultaneously dyestuffs and capillary-active substances such as the sewage waters of dyeing installations, can be efficiently be achieved by employing bis-guanylhydrazonium- and trisguanylhydrazonium salts. These salts form, with anionic compounds, saline derivatives which are very poorly water-soluble so that they can easily be removed. (Sinha-OEIS)
W79-04463

ORGANIC WASTE DRYING PROCESS,
Universal Oil Products Co., Des Plaines, IL. (Assignee).
V. Maffet.
U.S. Patent No. 4,121,349, 7 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 975, No 4, p 1299-1230, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Sludge treatment, Water pollution treatment, Organic wastes, Adsorption, Drying, Solid wastes, Fertilizers, Separation techniques, Volatile hydrocarbons.

A process for drying organic waste comprises the steps of passing an organic waste stream containing at least 20 wt.% water, volatile liquid hydrocarbons, and organic waste into a toroidal drying zone and effecting the vaporization of water and hydrocarbons and the formation of a drying zone effluent stream; admixing the solids recycle stream into the drying zone effluent stream at adsorption-promoting conditions; separating the drying zone effluent stream into a vapor stream and a dry solids stream containing less than 15 wt.% water; admixing a first portion of the dry solids stream into the drying zone effluent stream as the solids recycle stream; and forming a second portion of the dry solids stream into particles by extrusion. The unrecycled portion of dry solids extruded from compacted granules having good flow characteristics and suitable for application by commercial fertilizer spreaders. (Sinha-OEIS)
W79-04464

WATER PURIFICATION WITH FRAGMENTED OIL SHALE,
J. S. Kilburn.
U.S. Patent No. 4,121,662, 7 p, 1 fig, 14 ref; Official Gazette of the United States Patent Office, Vol. 975. No. 4, p 1406, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Organic wastes, Oil shales, Filtration, Separation techniques, Oil shale retorting, Hydrocarbon recovery, Steam generator blow-down.

Impurities are removed from impure water by introducing the impure water into a fragmented permeable mass of particles containing raw oil shale. The water introduced can be water containing hydrocarbons such as water obtained from retorting oil shale or water containing suspended solids such as blowdown from a steam generator. After introducing impure water into the fragmented permeable mass, the mass of particles can be retorted. This is particularly advantageous when the introduced water contains hydrocarbons because at least part of the hydrocarbons removed from impure water can be recovered by retorting. Preferably the fragmented permeable mass of particles is contained in an in situ oil shale retort in a subterranean formation containing oil shale because of environmental considerations. Since the fragmented mass containing oil shale remains in place under ground, the chance of surface contamination by the impurities removed from the water is reduced. (Sinha-OEIS)
W79-04465

PROCESS FOR TREATING SEWAGE, PARTICULARLY ON SHIPS,
H. G. Krugmann.
U.S. Patent No. 4,121,993, 6 p, 2 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 975, No 4, p 1512, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Sewage treatment, Electrolysis, Separation techniques, Ships, Equipment.

A process, particularly suitable in connection with the conditions which occur on board ships facilities the separation of impurities contained in the sewage from the water in an apparatus of limited dimensions so that the impurities can be removed permitting the water to be discharged outside the ship in a sufficiently pure form to prevent any harmful pollution of the surrounding waters. The problem is solved in that the sewage undergoes electrolysis so that the impurities assume a specific gravity differing from that of the water, leading to a spontaneous separation of the solids from the water through sinking or floating, following which the impurities are removed and eliminated alone and the clarified sewage can be discharged outside the ship. The apparatus comprises a detritus chamber, a metering and comminuting pump, a chemical container, a preliminary sedimentation tank, an electro-reactor vessel and a final sedimentation tank and sludge container attached in configuration and in parallel in the form of a compact unit in a common supporting frame. (Sinha-OEIS)
W79-04470

METHOD OF RESOLVING A MIXTURE OF OIL, WATER, AND SOLIDS,
Texaco Inc., New York. (Assignee).
F. Tao, and J. E. Warner.
U.S. Patent No. 4,122,009, 7 p, 4 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 975, No 4, p 1516, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oily water, Separation techniques, Oil industry, Baffles, Coalescence, Secondary Recovery(Oil), Solid wastes, Oil recovery.

A method for resolving a mixture of oil, water and solids includes flowing the mixture under and over two forwardly inclined baffles for settling out the solids and for causing oil drops to rise, collect, and flow in V-shaped grooves in the under side of the two baffles for coalescing the drops of oil into larger globs. The final steps of flowing the mixture over the upper forwardly declining baffle leave all coalesced oil on the surface for being drawn off as solids-free and water-free oil, and draw off water between the oil outlet and the solids outlet for producing oil-free and solids-free water. (Sinha-OEIS)
W79-04471

SEWAGE TREATMENT SYSTEM,
J. W. Greenleaf, Jr., and H. E. Schmidt.
U.S. Patent No. 4,122,013, 10 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1517-1518, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Anaerobic conditions, Anaerobic bacteria, Aerobic conditions, Oxidation, Nutrient removal, Sewerage.

A sewage treatment system is divided into two stages with a collection system dispersed between them. The first stage includes anoxic treatment units producing an anaerobic effluent which is moved through the vacuum tight collection system to the second stage of treatment including an oxidation unit producing an aerobic effluent containing nitrates, dissolved oxygen and activated sludge. The two liquids are mixed in a chamber and are subjected to treatment before discharge for producing a highly treated effluent from which a major part of the nutrients have been removed. (Sinha-OEIS)
W79-04473

SETTLING TANK,
Texaco Inc., New York. (Assignee).
F. Tao, and J. E. Warner.
U.S. Patent No. 4,122,016, 8 p, 4 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1519, October 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, Separation techniques, Settling basins, Baffles, Coalescence, Oil industry, Equipment, Secondary recovery(Oil), Oil recovery.

In oil fields environmental considerations require that the oil content of the produced water be reduced to an acceptable level, no more than 150-200 ppm of oil in the water discharged into rivers or streams nearby. Also clean water is most important for reinjecting into wells for secondary recovery. The primary object of this invention is to provide an improved settling tank for resolving a mixture of oil, water, and solids from an oil and solids-in-water influent. The settling tank includes two inclined and parallel baffles about which the influent water successively passes. Each baffle preferably has parallel V-shaped grooves in the under surface for entrapping, guiding, and coalescing the oil droplets into large globs for channeling and passing through the openinings between the baffles and the tank wall for rising to the surface for draw off. The clear water outlet is positioned on a horizontal plane intermediate horizontal planes through the low forward end of the upper baffle and the high rear end to ensure delivery of an oil-free and solids-free water. An upper oil outlet ensures delivery of a solids-free and water-free oil from the settling tank. (Sinha-OEIS)
W79-04474

APPARATUS AND PROCESS FOR TREATING CONTAMINATED WATER,
Sulzer Brs. Ltd., Winterthur (Switzerland). (Assignee).
J. Gnieser, and L. Pelloni.
U.S. Patent No. 4,123,341, 5 p, 1 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1969, October 31, 1978.

Descriptors: *Patents, *Water pollution treatment, *Industrial wastes, *Suspended solids, Turbidity, Electrodes, Coagulation, Separation techniques, Electrolytes, Conductivity, Equipment.

The process comprises the steps of passing contaminated water through an inlet line into an electrical field in an electro-coagulator to discharge the electrically-charged particles in the water while simultaneously dissociating at least some of the water, and coagulating the discharge particles and thereafter separating the coagulated particles from the water in a flotation stage while removing a flow of clarified water through an outlet line. The apparatus is provided with one or more turbidity meters in the inlet line to the electrocoagulator and the outlet line from the flotation state. The voltage across the coagulator electrodes is con-

trolled in response to a controller which receives signals from the respective turbidity meters. When the turbidity increases in either the inlet line or outlet line, the voltage is increased and when the turbidity decreases, the voltage decreases. In addition, upon an increase in voltage above a top limit, compressed air is charged into the coagulator while the rate of flow of recycled sludge is increased. Pressure in the coagulator is maintained during operation of the air compressor. (Sinha-OEIS)
W79-04477

METHOD AND APPARATUS FOR TREATING METAL CONTAINING WASTE WATER,
Gotzelmann KG Industrieabwasser-Anlagen, Stuttgart (Germany, F.R.). (Assignee).
R. Kammel, and H. Lieber.
U.S. Patent No. 4,123,340, 9 p, 2 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1969, October 31, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, Separation techniques, Electrolysis, Metals, Equipment, Product recovery.

A process is described in which it is possible to almost completely demetallize metal-containing waste waters, where the metals are recovered without the use of chemicals in a form enabling them to be reused directly. The method for treating metal containing waste water employes a vessel in which there is provided at least one anode and a cathode consisting essentially of electrically conductive particles. The waste water is subjected to electrolysis during which the waste water and the particles of the cathode are being moved. The particles of the cathode are arranged in a cage closed on all sides whose walls are perforated. The cage is moved by an external force during the electrolysis in order to move the particles. The waste water is simultaneously moved by producing a forced flow through the particles. An apparatus is provided for practicing the method. (Sinha-OEIS)
W79-04478

METHOD OF REMOVING OIL FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee).
R. E. Williams.
U.S. Patent No. 4,123,354, 7 p, 2 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1973, October 31, 1978.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, *Water quality control, *Oily water, Separation techniques, Absorption, Offshore platforms, Equipment, Outer Continental Shelf, Offshore petroleum industry.

A method for use in offshore operations is described whereby oil and water mixtures produced from an offshore well can be separated to permit the discharge of water into the sea. The oil and water mixture is injected into a partially submerged, vertical pipe and is contacted by an endless oleophilic, fibrous cord which is drawn through the pipe and which selectively removes the oil droplets from the waste water. The fibrous cord is drawn upwardly through the pipe in a direction counter-current to the flow of waste water. Oil which coalesces on the fibrous cord is squeezed from the cord at the surface while clarified waste water is discharged from the lower end of the pipe. Oil is removed from the fibrous cord by passing it through counter rotating rollers which compress the cord and squeeze the sorbed oil from it. (Sinha-OEIS)
W79-04479

SIMULTANEOUS TREATMENT OF SO2 CONTAINING STACK GASES AND WASTE WATER,
National Aeronautics and Space Administration, Washington, DC.
R. A. Frosch, J. C. Poradek, and D. D. Collins.
U.S. Patent No. 4,123,355, 6 p, 1 fig, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1973, October 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Air pollution, Pollution abatement, Separationtechniques, Sulfur compounds, Hydrogen ion concentration, Oxidation, Recycling, Stack gases, Sulfur dioxide, Scrubbers.

A portion of a sulfur dioxide containing gas stream, e.g., a stack gas, and a portion of a waste water stream such as derived domestic sewage is introduced into a first scrubbing zone, the waste water containing from about 500 to about 1200 parts per million iron. The first scrubbing zone is at a relatively low pH and an elevated temperature. The contact time in the first scrubbing zone is sufficient to permit substantial oxidation of absorbed SO2. The first scrubbing zone is essentially a closed loop system in which the waste water is continuously recycled through the scrubber. However, a portion, e.g. a slip stream, of the recirculating waste water in the first scrubbing zone is introduced, together with a second portion of the gas stream and a second portion of the waste water into a second scrubbing zone. The waste water in the second scrubbing zone contains an iron content lower than that in the first scrubbing zone. The SO2 introduced into he second scrubbing zone acidifies the waste water to reduce the bacteria to acceptable discharge levels after which the acidified waste water is treated to remove solids originally present. (Sinha-OEIS)
W79-04480

SEPTIC SYSTEM LIQUID LEVEL CONTROL APPARATUS,
B. Flagge.
U.S. Patent No. 4,123,358, 8 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1974-1975, October 31, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Septic tanks, Water levels, Flow control, Equipment, Degradation(Decomposition), Biodegradation.

Automatic liquid volume compensation apparatus is disclosed having particular application to septic systems. The apparatus limits septic tank air volume to optimize bacterial decomposition of wastes and controls the flow rate from the inlet piping through the tank to the drain field to limit passage of unprocessed fluid and prevent backups in the inlet piping. The first of two embodiments, a bladder within a settling tank inflates or deflates to accommodate changes in liquid volume while maintaining tank level within desired limits. In the second embodiment, an auxiliary tank stores excess liquid which is returned to the primary settling tank when settling tank liquid level has declined to a desired height. (Sinha-OEIS)
W79-04481

RECENT EFFLUENT COLOR REDUCTION TRIALS AT ALBERNI PULP AND PAPER,
Macmillan Bloedel Ltd., Nanimo (British Columbia).
R. W. Cunnington.
In Canadian Pulp and Paper Association Technical Section, Spring Conference, May 17-21, 1978, Jasper, Alberta, Preprint Proceedings, p 82-88. 5 fig, 2 ref, 6 tab.

Descriptors: *Bleaching wastes, *Color, *Surface waters, Water pollution effects, Wastes, Industrial wastes, Water pollution sources, Hydrogen ion concentration, Toxicity, Biochemical oxygen demand, Pulp and paper industry, Effluents, Aerated lagoons, Pulp wastes, Canada, Foreign countries, Newspring mills, Kraft mills.

Measurable improvements in effluent and receiving water color (about 50%) effluent pH variation, toxicity, and 5-day BOD were achieved at the Alberni Pulp and Paper Division of MacMillan Bloedel Ltd. (British Columbia) by HEH (as opposed to CEH) bleaching of the kraft newsprint furnish. Oxidation of the caustic extraction stage effluent by the addition of calcium hypochlorite reduced the lagoon influent color and had no effect on pH, toxicity, or 5-day BOD. The addition of clarified woodroom effluent to the aerated lagoon increased the color of the aerated lagoon effluent to a greater extent during the oxidation trial than during the HEH bleaching trial. (Swichtenberg-IPC)
W79-04499

5E. Ultimate Disposal Of Wastes

WASTE SURVEILLANCE IN SUBSURFACE DISPOSAL PROJECTS,
Louisiana State Univ., Baton Rouge.
R. Kazmann.
Ground Water, Vol. 12, No. 6, November-December 1974. Presented at the Second National Ground Water Quality Symposium, Denver, Colorado, September 25-27, 1974. 8 p, 9 fig, 14 ref. OWRT-A-002-LA(9), A-011-LA(5), A-022-LA(5), A-027-LA(5), and A-034-LA(1).

Descriptors: *Waste disposal, *Injection wells, Well spacing, Waste disposal wells, Aquifers, Monitoring, Computer programs, Mathematical studies, Equations, Hydrology, Wastes, Laboratory tests.

The monitoring procedures associated with deep-well disposal projects which are being investigated at Louisiana State University (LSU) are examined. The usual monitoring procedure employs an observation well drilled 300 feet or move in the nearest aquifer above the one used for disposal. Any transfer of fluid into the upper aquifer will theoretically show up as a pressure increase in the observation well. Barometric changes affect the rise in pressure caused by the leak and obscuring its detection. It is asserted that exploratory testing and monitoring programs should be designed to evaluate the target aquifer as a waste container to be monitored for many years. The method of computing the volumetric waste capacity of an aquifer is presented. LSU is currently writing a computer program for tracking the spread of wastes in the aquifer after they have been injected. A laboratory sized aquifer, termed a miniaquifer, is being used to verify the computer program. The positioning of monitor wells is of prime importance, and it is concluded that monitor wells should not be placed directly updip from the waste injection well when the density of the waste is greater than the density of the native water. (Davison-IPA)
W79-04097

THE ACCUMULATION AND ELIMINATION OF DIFLUBENZURON BY FISH,
California Univ., Fresno. Mosquito Control Research Lab.
For primary bibliographic entry see Field 5C.
W79-04321

PRODUCTIVE LAND USE OF DREDGED MATERIAL CONTAINMENT AREAS,
Amoco Production Co., Lafayette, LA.
B. S. Hubbard, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 320-327, 1977. 6 ref, 4 graph.

Descriptors: *Dredging, *Disposal, *Sites, *Land use, Land development, Land reclamation, Agriculture, Industries, Spoil banks, Recreation, Wildlife habitats, Dredged material.

A review of an international list of publications was made to gather examples of locations where dredged material was put to a productive use. A campaign by mail also was made to solicit responses from individuals, companies, and agencies active in the dredging industry around the world. About 150 sites were documented and classified. The categories of uses were commercial, industrial, recreational, wildlife habitats, agricultural, hydraulic control, transportation, research, and multipur-

pose. Analysis of the results indicated that commercial and industrial uses were the most prevalent. Maintenance dredging generated the material for a majority of the sites. The owners of the sites were usually local, state, or national governments. (See also W79-04351)(Humphreys-ISWS)
W79-04385

5F. Water Treatment and Quality Alteration

DETERMINATION OF THE TECHNICAL POTENTIAL OF THE LIME-MAGNESIUM CARBONATE PROCESS, VOLUME I,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 3A.
W79-04161

UPDATE: WHAT'S IN THE WATER.
National Water Well Association, Worthington, OH.
M. R. Richard.
Water Well Journal, Vol. 33, No. 1, p 84-85, January 1979.

Descriptors: *Organic wastes, *Regulation, *Water treatment, Water pollution, Epidemiology, Trihalomethanes, Carcinagens, Chloroform, Testing procedures, Monitoring, Groundwater.

Although EPA has not made a decision on its proposed regulations for trace organics in drinking water, several recent developments are reported. In Nassau County, New York, thrity-four of the County's 422 public supply wells have been restricted and 259 out of 3000 industrial and commercial plants have been identified as actual or potential discharges or organic compounds. The American Water Works Association recommended that the agency consider a maximum contaminant levels of 30 mg/l for chloroform in all public water supplies. The National Drinking Water Advisory Council proposed a 'period of research, testing and demonstration' of granular activated carbon in municipal water treatment plants. The National Academy of Sciences released a report which emphasized that noe of ten epidemiological studies have shown that trihalomethanes (THM's) in drinking water cause cancer. However, NAS believes the THM's in drinking water presents a human health hazard. The President's Council on Water and Price Stability called EPA's proposed limitations on organics 'costly' and 'inflationary'. Potential sources of organics contamination are listed and suggestions are made to ensure accuracy in testing for organics. (Purdin-NWWA)
W79-04242

YOU NEVER MISS THE WATER ... TILL THE WELL RUNS DRY,
For primary bibliographic entry see Field 6D.
W79-04244

EPA PROPOSED FAR-REACHING REGULATIONS FOR REDUCING SYNTHETIC ORGANICS IN DRINKING WATER.
Proceedings, American Society of Civil Engineers, Journal of Civil Engineers Division, Vol. 48, No. 3, p 69-71, March, 1978.

Descriptors: *Water treatment, *Potable water, *Water purification, *Water quality standards, Chlorination, Activated carbon, Public health, Water quality control, Standards, Water requirements, Municipal water, Cities.

The Federal Environmental Protection Agency recently proposed regulations for reducing synthetic organic chemicals found in drinking water. A maximum contaminant level (MCL) for total trihalomethanes (TTHM's) was established, and a treatment technique using granular activated carbon in the water treatment process is now required for control of synthetic organic chemicals. The end result will reduce the human exposure to chloroform and other THMs in drinking water, which occur as a result of the interaction of chlorine with natural organic substances in raw water. Surface water is more likely than groundwater to produce high THM levels after chlorination. The proposed MCL of 0.10 milligrams per liter for TTHM's in drinking water would initially apply to water systems serving more than 75,000 people. Systems serving populations of 10,000 to 75,000 would only be required to monitor THM levels. Of the 390 community water systems in the U.S. that serve more than 75,000 persons, 60 purchase water from other systems, and 18 do not presently add chlorine. Of the reaming systems, only 86 have TTHM's above 0.10 milligrams per liter. Thus, only these systems would have to make process changes and/or add carbon treatment. (Rule-Florida)
W79-04422

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

WATER PURIFYING SYSTEM AND PUMP THEREFOR,
J. D. Smith.
U.S. Patent No. 4,123,359, 6 p, 3 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1975, October 31, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Aeration, Bacteria, Cultures, Equipment.

The object is to provide a new and improved water purifying system and a pump which requires little or no cleaning operations, and having a relatively high flow rate without having the wetted surfaces being composed of corrosive materials. The system generally comprises a porous bag containing a mixture of natural ingredients resting on the top surface of a perforated plastic plate which is supported above the bottom wall of the container by any convenient means, such as a set of spaced-apart rocks. Gravel is placed over the bag and the plate to conceal it from view and a suction tube draws water from under the plate by means of a pump placed within a sump box attached to the top edge of the container. In use, a bacteria culture is established and maintained in the bed formed by the mixture of natural ingredients so that the bacteria culture cleans the water in the container. The overflow lip serves to aerate the water by flowing it through air in a water fall effect. The aerated recirculated water flows through the natural ingredients to facilitate the proliferation of the bacteria. (Sinha-OEIS)
W79-04460

ELECTROLYTIC CELL FOR TREATMENT OF WATER,
Firma Hans Einhell G.m.b.H. Industriegelande, Landau (Germany, F.R.). (Assignee).
J. Miller, and F. Stummer.
U.S. Patent No. 4,121,991, 8 p, 4 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 4, p 1512, October 24, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Electrolysis, Electrodialysis, Electrodes, Ions, Hardness(Water).

An electrolytic cell is described for the treatment, particularly the purification and sterilization of water, which comprises a closed container with a lower inlet opening and an upper outlet opening for the water and electrodes which are adapted to be connected with the positive pole and the negative pole of a DC source. In the interior of the electrolytic cell free movable particles are located whose density is higher than that of the water to be treated and which are prevented from leaving the electrolytic cell by suitable means adjacent to the inlet and the outlet. The movable particles, by their agitation, continuously scratch off any deposits formed on the surfaces of the electrodes. One embodiment of the invention effects electrodialysis by using an electrodialysis diaphragm surrounding the anode, forming a closed anode compartment, where water flows at a very slow rate compared with the main flow or not at all and where the negative ions are concentrated. (Sinha-OEIS)
W79-04469

5G. Water Quality Control

RECREATION BENEFITS OF WATER QUALITY: ROCKY MOUNTAIN NATIONAL PARK, SOUTH PLATTE RIVER BASIN, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W79-04004

THE ADDITIVE AND INTERACTIVE EFFECTS OF POWERLESSNESS AND ANOMIE IN PREDICTING OPPOSITION TO POLLUTION CONTROL,
Illinois Univ. at Urbana-Champaign.
R. H. Orr.
Rural Sociology, Vol. 39, No. 4, Winter 1974, p 471-486. 4 tab, 23 ref. OWRT B-052-ILL(3). 14-31-0001-3275.

Descriptors: Water pollution control, Waste water disposal, Social aspects, Political aspects, Psychological aspects, *Attitudes, *Illinois, Anomie.

The additive and interactive effects of different aspects of alienation on attitudes toward pollution control were determined for residents of an Illinois community which was concerned with a sewage treatment issue. A sample of 213 community residents of voting age was obtained and questionnaires were administered during May, 1971. Powerlessness and anomie, while not additive, acted interactively to explain opposition to pollution control. Furthermore, this relationship was characterized by a 'saturation' or diminishing return effect. Alienation produced negativism toward the issue up to a certain point, with a subsequent increase serving to lessen the issue opposition. The interaction effect was found to exist controlling for respondent socioeconomic and demographic characteristics.
W79-04010

TRANSIENT TEMPERATURE EFFECTS ON BOD AND DO CONCENTRATIONS ALONG A STREAM,
Kansas State Univ., Manhatten. Dept. of Chemical Engineering.
S. H. Lin, L. T. Fan, and L. E. Erickson.
Water Research. Vol. 7, p 1861-1873, 1973. 11 fig, 14 ref. OWRT B-015-KAN(14), B-021-KAN(7), B-030-KAN(5).

Descriptors: *Thermal pollution, Oxygen sag, Dissolved oxygen, Biochemical oxygen demand, Stream dynamics, Model studies, Heated water.

A transient version of Dobbins' dispersion model is extended to include the effect of temperature on BOD and DO concentrations along a stream. Waste heat discharge from a power plant is considered as the main cause for the temperature change. Effects of the axial dispersion coefficient, stream velocity, initial BOD concentration and DO removal rate on BOD and DO concentration levels are examined parametrically.
W79-04087

SOUTH PLATTE RIVER BASIN ACCOMPLISHMENT PLAN.
Environment Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 246,

Price codes: A08 in paper copy, A01 in microfiche. December 4, 1972, 174 p.

Descriptors: *Water quality standards, *Regional planning, *Water quality data, *Water pollution, *Water quality, *Water pollution abatement, *South Platte River Basin, *Denver(CO), Biochemical oxygen demand, Coliform bacteria, Dissolved oxygen, Total suspended solids, Waste water disposal, Waste treatment, Industrial wastes, Sewerage, Sewage treatment, Colorado, Nebraska, Waste treatment facilities, Point source pollution, Government policies.

This Accomplishment Plan applies to the headwaters of the South Platte River Basin near the Colorado/Nebraska border, covering 350 main stem stream miles plus 469 tributary stream miles. The Basin encompasses Denver and surrounding counties, containing the largest metropolitan area in Region VIII. Municipal discharges and wastes from sugar beet processing plants and other industrial operations are the major waste sources. Present Colorado wastewater treatment plant standards are not adequate to meet ambient stream standards in most areas. The report discusses pollutant loadings, water quality standards, and tactical solutions to pollution problems so that water quality in the Basin would meet proposed standards by July 1, 1976. Tables of basin load summaries are presented listing fifth day BOD and coliform levels, proposed decreases of these levels over FY's 73-76, water quality objectives, and the year in which the minimum acceptable water quality levels are to be achieved. A chronological ordering of planned accomplishments is shown outlining specific actions EPA officials should take to insure adequate water quality in the region. Principal point source loads and locations are listed along with the type and amount of pollutant each source discharges. Tactical solutions are offered based on particular situations and problems with a timetable and manpower schedule for instituting the proposed solutions. The report ends by listing each discharger and the schedule for pollution reduction levels required by each to meet ambient water quality standards by July FY '76. (Coan-NC)
W79-04145

EFFECT OF SALINITY ON AGRICULTURE IN IRAQ,
Mosul Univ. (Iraq). Coll. of Engineering.
For primary bibliographic entry see Field 3F.
W79-04173

WATER QUALITY IMPROVEMENT IN SMALL PONDS,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering.
J. E. Garton, and R. E. Punnett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 147, Price codes: A02 in paper copy, A01 in microfiche. Oklahoma Water Resources Research Inst., Oklahoma State Univ. Technical Completion Report, 1978. 10 p, 3 fig, 1 tab, 4 ref. OWRT A-065-OKLA(2), 14-34-0001-8038.

Descriptors: *Ponds, Hypolimnion, Pumps, Lake of the Arbuckles, Ham's Lake.

A simple method of determining destratifier design criteria was developed for water quality improvement in small ponds using a Garton pump. The method is based upon two major objectives: (1) to penetrate to the bottom of the pond with downward pumped surface waters; and (2) to pump a volume of water equal to the normal hypolimnion every two days. The data are presented in tabular form. From the table the advantage of using larger diameter pumps is apparent.
W79-04261

PROTOTYPE REAERATION MEASUREMENTS, BELTZVILLE DAM, PENNSYLVANIA,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
E. D. Hart.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York p 280-286, 1977. 4 fig, 2 ref.

Descriptors: *Reaeration, *Water quality, *On-site tests, *Pennsylvania, Reservoir releases, Withdrawal, On-site data collections, Measurement, Dissolved oxygen, Water temperature, Dams, *Beltzville Dam(PA).

Prototype water quality tests were conducted at Beltzville Dam during August 1976. The purposes of these tests were to determine the location and degree of reaeration of flow that occurs as it passes through the outlet works and to provide prototype data with which to evaluate the accuracy of the Army Engineer Waterways Experiment Station (WES) selective withdrawal computer model, SELECT. Twelve tests were conducted. Temperture and dissolved oxygen data (vertical profiles) were collected upstream of the dam, at seven stations within the outlet structure, and at one station in the downstream channel. The tests involved various flow rates and intake levels. The results of these prototype tests showed: (1) the dissolved oxygen content of the release flows was approximately 90 to 95% of the saturation level regardless of the dissolved oxygen content of the flow entering the structure or the discharge, and major reaeration occurred within the outlet structure downstream of the water-quality gate; and (2) the predictions of the SELECT model were in close agreement with the observed data. (See also W79-04351)(Humphreys-ISWS)
W79-04380

AMERICAN DREDGING COMPANY V. STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION (ORDER BANNING DUMPING OF DREDGE SOIL IN PROTECTED WETLANDS AREA UPHELD),
161 N.J. Super. 504, 391 A.2d 1265-71 (1978).

Descriptors: *Wetlands, *Dredging, *Eminent domain, *New Jersey, Regulation, Public benefits, Land use, Land classification, Property values, Coastal engineering, Environmental control, Legislation.

Plaintiff, a New Jersey dredging company, sought to overturn an order of the New Jersey Department of Environmental Protection (DEP), which prohibited the company from placing dredged materials on certain lands the company owned. Plaintiffs contended the order was void in that it constituted a taking of property without the payment of just compensation. The DEP's order was issued pursuant to a state statute designed to protect and preserve coastal wetlands. The statute designated 159 acreas of the plaintiff's land as wetlands and made them subject to the DEP's regulatory authority. On appeal, the court held that the order prohibiting deposits of dredge soil was not unreasonable and did not constitute a taking of the plaintiff's land without compensation. The court stated that the DEP restriction was a valid exercise of the state's police power. The restriction while resulting in a diminution in the land's economic value, did not require compensation. The order promoted a substantial public purpose, namely the protection of wetlands. The reasonableness of such restrictions requires a case-by-case determination. (Hucks-Florida)
W79-04415

SECTION 404 OF THE FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977: HYDROLOGIC MODIFICATION, WETLANDS PROTECTION AND THE PHYSICAL INTEGRITY OF THE NATION'S WATERS,
For primary bibliographic entry see Field 5A.
W79-04419

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
For primary bibliographic entry see Field 5D.
W79-04421

EPA PROPOSED FAR-REACHING REGULATIONS FOR REDUCING SYNTHETIC ORGANICS IN DRINKING WATER.
For primary bibliographic entry see Field 5F.
W79-04422

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 6E.
W79-04425

WISCONSIN'S ENVIRONMENTAL DECADE, INC. V. DEPARTMENT OF NATURAL RESOURCES (CITY POLICY COULD NOT PREVENT CHEMICAL TREATMENT OF STATE WATERS),
For primary bibliographic entry see Field 2H.
W79-04428

CITIZENS' COMMITTEE TO PRESERVE LAKE LOGAN V. WILLIAMS (STATE AGENCY'S MAINTENANCE OF WATER QUALITY THROUGH CONTROL OF EFFLUENTS FOUND TOO STRICT),
For primary bibliographic entry see Field 5D.
W79-04430

CORPORATE COMPLIANCE AND COMPENSATION PROBLEMS IN ENVIRONMENTAL PROTECTION: IMPLICATIONS OF UNITED STATES V. RESERVE MINING COMPANY,
J. H. Tucker.
Natural Resources Lawyer, Vol. 10, No. 3, p 555-90, 1977.

Descriptors: *Pollution abatement, *Great lakes, *Industrial wastes, *Cost analysis, Regulation, Water pollution, Environmental control, Public health, Legislaton, Mineral industry, Water quality, Judicial decisions.

The costs and impact of pollution across the country have reached staggering proportions. Both federal and state governments have made extensive commitments to the reduction of pollution and the maintenance of a clean environment. A crucial consideration in the effort to abate pollution is that of cost. Determination of who will bear the costs of cleaning up the environment and how the money will be spent is necessary before any effective program can begin. Various solutions to the problem of financing pollution control are identified and discussed. Reserve Mining Co. v. Environmental Protection Agency, a recent federal case involving the finance issue and arising in Minnesota, is discussed. The case offers a textbook example of the various and often conflicting social, economic and political considerations which face a court dealing with industrial pollution. The history and legal impact of the Reserve decision is also discussed. In addition, suggestions are made for achieving corporate compliance with pollution regulations, apportioning costs throughout society and compensating those persons damaged by pollution. New approaches are need to ensure corporate compliance with environmental control measures. (Hucks-Florida)
W79-04431

COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V. CITY OF LEBANON (COMPULSORY FLUORIDATION HELD TO BE A FURTHERANCE OF PUBLIC HEALTH).
393 A. 2d 381-86 (Pa. 1978).

Descriptors: *Flouirdation, *Public health, *Administrative decisions, *Pennsylvania, Water qual-

ity, Permits, Water supply, Regulation, Administrative agencies, Chemicals, Water treatment, Cities.

Plaintiff city, which began to floruidate its water supply in 1972, sought permission of the Pennsylvania Department of Environmental Resources (DER) to cease such flouridation. The request was denied, and the city appealed, contending the DER had abused its discretion by refusing the city's request for discontinuation of the flouridation as a condition to receiving a water permit. The Pennsylvania Supreme Court held that the DER had the power--for protection of public health--to prohibit the alteration of the chemical composition of the water by the city without DER approval. The evidence supported by DER conclusion that flouridation of domestic water supplies was an important means of preventing tooth decay, especially in children, and thereby protecting the public health. Assuming that the DER had the authority to require applicants to undertake flouridation as a condition to obtaining a water supply permit, the fact that the DER did not enforce such a requirement did not render defective its refusal to sanction the proposed abandonment of flouridation by a permit holder. (Hucks-Florida)
W79-04433

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
For primary bibliographic entry see Field 6E.
W79-04439

POPE V. CITY OF ATLANTA (ACT REGULATING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITUTIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
For primary bibliographic entry see Field 6E.
W79-04452

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
For primary bibliographic entry see Field 6E.
W79-04457

OIL-WATER SEPARATOR,
Ballast-Nedam Groep, N. V., Amstelveen (Netherlands).
C. G. Middelbeek.
U.S. Patent No. 4,123,365, 4 p, 2 fig, 18 ref; Official Gazette of the United States Patent Office, Vol 975, No 5, p 1977, October 31, 1978.

Descriptors: *Patents, *Oil pollution, *Water pollution treatment, Separation techniques, Water quality control, Equipment, Gravity separation.

A separator is described for two liquids, in which the heavy liquid is separated from the light liquid such as oil and all light liquid is discharged through the inlet chamber and all heavier liquid is transmitted further via a drain provided underneath the separator. The device includes a tank having opposing end walls spaced from each other and a separator, comprising two parallel inclined plates spaced from each other, in the tank. The separating device also includes an inlet in one end wall of the tank for the liquid to be purified, a first outlet in the other end wall of the tank for the purified liquid, and an overflow between the first outlet and the separator. The one end wall of the tank and the one of the two parallel plates closest to the one end wall are spaced throughout their extend from each other and define a space between them to substantially eliminate turbulence of the liquid before entering the separator. The separating device also includes a second outlet for substances to be separated that are lighter than the purified liquid. The second outlet is in the upper end of the one end wall of the tank above the inlet. (Sinha-OEIS)
W79-04461

ELECTROLYTIC CELL FOR TREATMENT OF WATER,
Firma Hans Einhell G.m.b.H. Industriegelande, Landau (Germany, F.R.). (Assignee).
For primary bibliographic entry see Field 5F.
W79-04469

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OBTAINING SPECIFICATIONS FOR MINIMUM COST IRRIGATION SYSTEMS,
Idaho Univ., Moscow. Dept. of Agricultural Engineering.
J. R. Busch.
In: Proceedings of the ASCE Irrigation and Drainage Division Specialty Conference, Logan, Utah, August 13-15, 1975, p 456-475. 12 fig, 2 tab, 12 ref, 1 append. OWRT B-028-IDA(3) and B-033-IDA(4).

Descriptors: *Irrigation, *Distribution systems, *Cost analysis, *North Rigby Irrigation District, Jefferson County, Idaho, Model studies, Irrigation programs, Capital costs, Operating costs, Annual costs, Pipelines, Irrigation design, Irrigation efficiency, Irrigation engineering, Channeling, Pumping, Water management(Applied), Sprinkler irrigation, Cost comparison.

A procedure for selecting and arranging irrigation system components, in compliance with all constraints, at a minimum cost is presented. The North Rigby Irrigation District in Jefferson County, Idaho, was used as a test area for developing the methodology, where several alternative application and distribution system components were considered in addition to the existing system. Improved gravity, hand-line, and side-roll sprinkler systems were added to the unimproved gravity system. Alternative distribution systems considered included the existing unlined channel system, lined channel, gravity pipeline, high pressure pipeline, and wells with low and high head pumps. Lined and unlined channels and gravity pipeline were considered to be compatible gravity components. Annual costs obtained and projected for the present and proposed systems included capital costs, labor costs, machine hire, and management and operation costs. The results of this model formulation indicate which types of system components would best meet a given set of conditions. (Davison-IPA)
W79-04012

CONVECTIVE CONTAMINANT TRANSPORT TO PUMPING WELL,
Geological Survey, Syosset, NY. Water Resources Div.
For primary bibliographic entry see Field 5B.
W79-04022

FLOOD FREQUENCY OF SMALL STREAMS IN ALABAMA,
Geological Survey, University, AL. Water Resources Div.
D. A. Olin, and R. H. Bingham.
Alabama Highway Department HPR No. 83, August 1977. 44 p, 12 fig, 1 tab, 10 ref.

Descriptors: *Flood forecasting, *Flood frequency, *Flood recurrence interval, *Alabama, *Small watersheds, Analytical techniques, Regression analysis, Equations, Estimating, Streamflow, Peak discharge, Channel morphology, Geomorphology, Drainage area.

Equations have been developed for estimating future floods for 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals on natural streams in Alabama with drainage areas of 1 to 15 square miles. One equation for each recurrence interval applies statewide. The equations were developed by multiple regression analysis of flood magnitudes obtained from both observed peak discharges and synthetic discharge data generated with a calibrated rainfall-runoff model, and physical basin characteristics. The regression analysis indicated that drainage area and main channel slope are the most significant basin characteristics affecting flood frequency and magnitude. Those characteristics can generally be determined from topographic maps. (Woodard-USGS)
W79-04024

HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W79-04026

A MATHEMATICAL MODEL OF MONTHLY FLOW SEQUENCES,
Technical Univ. of Istanbul (Turkey).
For primary bibliographic entry see Field 2E.
W79-04054

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 7C.
W79-04081

PLANNING FOR PROPER USE OF LAND AND WATER.
Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 888, Price codes: A05 in paper copy, A01 in microfiche. July 1977. Spring Quarter Seminar Series, 1977. 92 p, 6 fig, 31 ref. OWRT-A-999-ORE(20).

Descriptors: *Water resource development, *Water management(Applied), *Oregon, *Planning, Regional development, Urbanization, Columbia River, State government, Local government, Interstate commissions, Water allocation, Watershed management, Legal aspects, Pacific Northwest.

A compilation of papers from a weekly series examining some aspects of land and water planning in Oregon is presented. The Water Resources Research Institute, on the campus of Oregon State University, serves the state by fostering, encouraging, and facilitating water research; it administers and coordinates statewide and regional programs of multidisciplinary research in water and related land resources. Topics covered are: planning of water and land use in the Pacific Northwest; Oregon planning in the nonpoint source areas of forestry, agriculture, septic tanks, and water resources; comprehensive planning in a small Oregon community; the role of regional government in planning; planning and the allocation of water resources; management of the Columbia River; flood plain management; urbanization and water resources planning; and the controversy surrounding the Bull Run Watershed. (Davison-IPA).
W79-04113

HYDROLOGIC AND WATER QUALITY MODELING OF SURFACE WATER DISCHARGES FROM MINING OPERATIONS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
E. E. Herricks, V. O. Shanholtz, and D. N. Contractor.
Virginia Polytechnic Institute and State University, Department of Agricultural Engineering, Research Division Report No. 159, January 1975. 44 p, 7 fig, 9 tab.

Descriptors: *Mine drainage, *Hydrologic models, *Sediment transport, Analytical techniques, Mathematical studies, Overland flow, Channel flow, Galerkin's techniques.

A parametric, lumped system model was successfully used to generate continuous streamflow sequences for areas having no historical record. These data provided a synthetic record for evaluating a steady state conservative SO4 model. Simulated SO4 concentrations, which give an indiction of both amount and intensity of acid mine drainage, showed acceptable agreement with actual concentrations. The cleansing action of a given storm system was predicted by sediment transport theory and hydrologic models. A table delineating the maximum size of sediment that could be moved as a function of stage is presented. The application of finite element methods, using Galerkin's technique, was successfully used to solve the one-dimensional unsteady partial differential equations of continuity and momentum (with kinematic wave approximation) for overland and channel flow. The effect of geometric alterations typical of surface mining is illustrated.
W79-04134

PLANNING FOR WATER RESOURCES,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 6D.
W79-04152

A METHOD FOR PARAMETER SENSITIVITY ANALYSIS IN DIFFERENTIAL EQUATION MODELS,
Albany Medical Coll., NY. Div. of Computer Science.
R. C. Kohberger, D. Scavia, and J. W. Wilkinson.
Water Resources Research, Vol. 14, P 25-29, February, 1978. 4 fig, 4 tab, 13 ref.

Descriptors: *Mathematical models, Least squares method, *Analytical techniques, Probability.

A numeric method for analyzing global parameter sensitivity about a fixed point in parmeter space for differential equation models is presented. The method is suitable for large-scale, multiresponse systems which may not be in steady state. By using a quadratic model, the relationship between several global response characteristics and parameter perturbations is examined. Sensitivity relaionships are defined with both backward elimination regression model selection procedures and eigenvalue-eignenvector analyses. An example of the method is given using an ecosystem model consisting of 14 coupled differential equations. (Skogerboe-Colorado State)
W79-04229

ON OSCILLATION OF NUMERICAL SOLUTION OF A MODIFIED RICHARDS' EQUATION,
Utah International Inc., San Francisco, CA. Dept. of Environmental Quality.
For primary bibliographic entry see Field 2G.
W79-04231

TOPOLOGICAL CLASSIFICATIONS OF DRAINAGE NETWORKS: AN EVALUATION,
Indiana Univ., Bloomington. Dept. of Geography.
For primary bibliographic entry see Field 2A.
W79-04232

DRAIN-HOLE DRILLING CAN INCREASE PRODUCTIVITY,
EG and G Idaho, Inc., Idaho Falls.
For primary bibliographic entry see Field 8A.
W79-04249

TECHNOLOGY AND DESERTIFICATION,
Escuela Nacional de Agricultura, Chapingo (Mexico)
M. Anaya-Garduno.
Economic Geography, Vol. 53, No. 4, p 407-412, Oct. 1977. 36 ref.

Descriptors: *Arid lands, *Technology, *Desertification, Planning, Water management(Applied), Comprehensive planning, Project planning, Water resources development, Regional development, Groundwater, Soil conservation, Farm management, Water supply, Irrigation systems, Soil erosion, Vegetation establishment, Biodegradation, Energy, Conservation.

In solving the major problems in arid regions and reversing the processes of desertification, modern technology has played both a constructive and destructive role. Numerous examples of destructive technology are evident in the mismanagement of irrigation water, over-exploitation of groundwater, deficient drainage systems, sedimentation and siltation, loss of fertile soil due to injudicious farming systems, reduction of vegetative protection of the soil and inadequate location of watering points. It is contended here that proper management systems combined with appropriate technological inputs offer the best prospects for successfully combatting deterioration in arid regions. Three principles should be taken into account when determining the appropriate technologies to employ in combatting desertification: (1) start anti-desertification action with the less deteriorated systems of production, (2) use intermediate technology wherever possible, and (3) consider traditional indigenously developed technologies before establishing new land use systems. Problems generated by the physical and biological degradation of land use systems are surveyed and appropriate technologies considered in this analysis under five categories: (1) scarcity of water (2) irrigation water mismanagement, (3) soil erosion, (4) reduction of vegetation cover and animal productivity, and (5) scarcity and misuse of energy. (Tickes-Arizona)
W79-04283

RESETTLEMENT AND DESERTIFICATION: THE WAGOGO OF DODOMA DISTRICT, TANZANIA,
Dar es Salaam Univ. (Tanzania).
A. C. Mascarenhas.
Economic Geography, Vol. 53, No. 4, p 376-380, Oct. 1977. 2 ref.

Descriptors: *Regional analysis, *Desertification, *Rural sociology, *Dry farming, *Social impact, *Resettlement, Water shortage, Regional economics, Social aspects, Resource allocation, Social adjustment, Local governments, Droughts, Arid lands, Flood damage, Tanzania.

The contrasting catastrophies of drought and flooding have beseiged arid Tanzania since its early years of independence. Dodoma, a region in central Tanzania is analyzed here to illustrate the effects of desertification upon the people and the consequences of resettlement. The sedentary but mobile Wagogo people have paradoxically subsisted upon cereals while maintaining a value system almost entirely oriented toward pastoralism and cattle raising. Although these people have periodically undergone great suffering imposed by the water shortages and environmental stresses of the desert, they have chosen to remain in Dodoma, and try to master the environment. Following the 1969 drought, however, the government began to implement a plan to resettle these people in planned villages. The experiences of one household are described here to illustrate that while the government resettlement program has had the highest and best motivations, real problems and difficulties have resulted. The adaptative potential of traditional livelihoods, the pace at which development can or should take place, and Tanzania's dependent position in the global economic system are the major variables effecting the development of this region. Documented here is the willingness of the pastoral people to move to concentrated village settlements and their equal unwillingness to abandon their traditional values. (Tickes-Arizona)
W79-04296

WATER CONTROL AND DESERTIFICATION, THE RESETTLED NOMADS OF DEH LURAN, IRAN,
Toronto Univ. (Ontario).
A. Whyte.
Economic Geography, Vol. 53, No. 4, p 372-375, Oct. 1977. 2 ref.

Descriptors: *Political constraints, *Economic impact, *Social impact, *Nomadism, Water resources development, Migration, Economic feasibility, Social aspects, Social needs, Rural sociology, History, Irrigation practices, Social adjustment, Transhumance, Pastures, Arid lands, Iran.

In the 40 years since the Iranian Government's resettlement policy was inaugurated the Zagros foothills village of Deh Luran may be considered representative of the continuing dilemmas faced when any such attempt at social reconstruction disrupts traditional life styles. While its present 1500 inhabitants struggle with a subsistence agriculture, made more uncertain by serious desertification, they see their nomadic relations still using the village as a stopping point in their continued migratory life. Archaeological records, however, reveal a dynamic equilibrium established in ancient times between increasing ecological aridity and increasing human control of water resources through irrigation systems based on sophisticated water works. In modern time, however, the sudden imposition of settlement life without the wealth and organization to invest in high technology has created an imbalance which will require an accommodation permitting a mixed strategy of transhumance between two permanently located villages where advantages of herding could be combined with a stable agriculture and settlement infrastructure. (Tickes-Arizona)
W79-04306

DIGITAL SIMULATION AND PREDICTION OF WATER LEVELS IN THE MAGOTHY AQUIFER IN SOUTHERN MARYLAND,
Geological Survey, Towson, MD. Water Resources Div.
F. K. Mack, and R. J. Mandle.
Maryland Geological Survey Report of Investigations No. 28, 1977. 42 p, 25 fig, 7 tab, 41 ref.

Descriptors: *Model studies, *Groundwater availability, *Maryland, *Coastal plains, *Aquifer characteristics, Confined water, Analytical techniques, Mathematical models, Regression analysis, Forecasting, Water supply, Water demand, Water yield, Groundwater recharge, *Anne Arundel County, *Prince Georges County, *Charles County, *Calvert County.

A digital model of the Magothy aquifer, an important source of water for the Coastal Plain of Maryland, was developed to provide county planners in southern Maryland with information on the availability of water from this source. The digital model is based on a U.S. Geological Survey computer program which employs the iterative alternating-direction implicit procedure (IADIP) to solve finite-difference approximations of the groundwater flow equations in two dimensions. The model was calibrated by adjusting hydrologic parameters until computed drawdowns matched historic drawdowns measured in several observation wells. Great differences exist in the amount of water available from one part of the project area to another because of the variability of the transmissivity of the aquifer and the amount of available drawdown. A series of tests that stressed the model by pumping from hypothetical wells located in the best hydrogeologic parts of each county, using projected water demands of the year 2000, indicated adequate supplies would be available from the Magothy in southern Anne Arundel County and northern Calvert County, but not in Charles or Prince Georges Counties. (Woodard-USGS)
W79-04399

OPTIMIZATION TECHNIQUES APPLIED TO GROUND-WATER DEVELOPMENT,
Geological Survey, Reston, VA. Water Resources Div.
S. P. Larson, T. Maddock, III, and S. S. Papadopulos.
In: Proceedings of Symposium on the Optimal Development and Management of Groundwater, Birmingham, England, July 1977: International Association of Hydrogeology, p E57-E66, 1977. 3 fig, 6 ref.

Descriptors: *Groundwater, *Safe yield, *Optimization, *Computer models, Water wells, Drawdown, Aquifers, Mathematical models, Water management(Applied), *Nonlinear systems, *Nonlinear programming.

A management model was used to determine the 'safe yield' of an unconfined aquifer near Carmel, Indiana. To develop the management model a quasi-linearized digital aquifer model was combined with a nonlinear optimization program. Response functions determined from the aquifer model provided a basis for optimization subject to a set of constraints. Potential well sites were restricted to areas of high transmissivity and a minimum discharge of 0.8 cubic foot per second (0.02 cubic meter per second) was required from potential wells. Drawdowns throughout the potential well-site areas were restricted to half the initial saturated thickness. The results demonstrate that management models provide a useful formal procedure for determining the safe yield of aquifers under a given set of constraints. (Woodard-USGS)
W79-04406

THE LEGAL SIGNIFICANCE OF THE LOCAL GOVERNMENT COMPREHENSIVE PLAN,
For primary bibliographic entry see Field 6E.
W79-04420

COASTAL COMMUNITIES - PARTNERS OR PUPPETS IN OUTER CONTINENTAL SHELF DEVELOPMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy; and Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 6E.
W79-04426

NOTES ON CALIFORNIA'S COASTAL GOVERNANCE: A REPLY TO PETER DOUGLAS,
California Univ., Berkeley. Inst. of Governmental Studies.
S. Scott.
Coastal Zone Management Journal, Vol. 4, No. 4, p 475-85, 1978.

Descriptors: *California, *Local government, *Coasts, *Comprehensive planning, Legislation, State government, Regulation, Permits, Regions, Programs, Shores.

In recent years California has instituted several programs aimed at effectively governing and regulating coastal areas. In 1972, Proposition 20 set up a state coastal commission and provided for six regional commissions to assist in coastal planning activities. In 1976, Proposition 20 was replaced by a new California coastal law. The new law provides for the eventual termination of the regional commissions. The coastal planning process which was previously a part of the duties of the regional commissions will be shifted downward to local government by making the cities and counties principal participants in a state-regional-local collaborative planning process. Under the 1976 law, local governments are preparing their own local coastal programs. These local programs are subject to state approval. Some debate has ensued as to whether the regional commissions should be retained as an intermediate part of the state-local collaborative plan. The various arguments for and against maintaining the three-tier state-regional-local program of coastal regulation are analyzed and discussed. (Hucks-Florida)
W79-04444

FEDERAL LANDS AND CONSISTENCY: AN INTERGOVERNMENTAL PLANNING PROPOSAL FOR THE COASTAL ZONE,
B. H. Williamson.
Coastal Zone Management Journal, Vol. 4, No. 4, p 435-55, 1978. 2 fig.

Descriptors: *Federal-state water rights conflicts, *Resource development, *Coasts, *Comprehensive planning, Federal government, Federal jurisdiction, State government, State jurisdiction, Planning, Washington, Legislation, Management.

In order to preserve, protect, develop and enhance the resources of the nation's coastal zone, the federal Coastal Zone Management Act of 1972 (CZMA) was enacted as a federally funded, water related program designed to assist participating states in meeting increasing and competing demands being made on the coastal zone. In defining the scope of state coastal zone management programs permitted under the CZMA, federal-state conflict has arisen over the exclusion of federal lands from the coastal zone and the extent that state regulatory authority may be exercised over federal actions that have an impact on the coastal zone. In order to alleviate this conflict and promote the Congressional goal of unified and consistent federal-state policies regarding public and private use of coastal resources, this article proposes an inter-governmental planning mechanism. This mechanism would incorporate the 'consistency requirements of the CMZA with federal ownership, use and regulation of coastal zones.' This approach is viewed as the best method of eliminating the long-standing struggle between the federal government and the states over jurisdiction and control of coastal resources. (Hucks-Florida)
W79-04446

ACCESS TO THE NATION'S BEACHES: LEGAL AND PLANNING PERSPECTIVES,
National Oceanic and Atmospheric Administration, Washington, DC. Office of Sea Grant.
D. Brower.
Sea Grant Publications UNC-SG-77-18. Available from UNC Sea Grant, 105 1911 Building, North Carolina State University, Raleigh, North Carolina, 143 p, February, 1978. 2 app.

Descriptors: *Beaches, *Public rights, *Public access, *Planning, Access routes, Recreation facilities, Easements, Oceans, Prescriptive rights, Eminent domain, Coasts, Shores.

Insufficient public access to the nation's coastal beaches has long been recognized as a problem worthy of examination. At the same time, as recreational needs are increasing seashore resources are dwindling. Seashores, especially those with sandy beaches, are a unique natural resource with unusually high recreational qualities. Two methods of making beaches available for public use are discussed herein. The first is the creation of a public right to use the beach on at least a part of it. Another method would be to place portions of the shore in public ownership. Both states and the Federal government have instituted programs aimed at the problems of ownership and access. Several states have enacted 'Open Beaches' statutes which declare certain portions of the shoreline as being in the public domain. These statutes are examined along with measures such as the public trust doctrine, implied dedication, customary rights and prescriptive easements. There is an emphasis of legal tools available for preserving, perfecting and acquiring beach access. Finally various federal programs related to beach access are discussed. (Hucks-Florida)
W79-04448

POPE V. CITY OF ATLANTA (ACT REGULATING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITUTIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
For primary bibliographic entry see Field 6E.
W79-04452

TESTING SOCIAL INDICATORS IN THE TECHCOM MODEL FOR WATER DEVELOPMENT,
Utah State Univ., Logan. Inst. for Social Science Research on Natural Resources.
W. H. Andrews, G. E. Madsen, and C. W. Hardin.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 281, Price codes: A10 in paper copy, A01 in microfiche. ISSR Research Monograph No. 8, January 1979, 187 p, 8 fig, 21 tab. OWRT C-7106(No 6210)(1), 14-34-0001-6210.

Descriptors: Evaluation, *Water resources planning, *Model studies, Social aspects, Multiple purpose projects.

The major objectives were to relate four of the major goals of the Techcom model to comparable elements identifiable in an actual ongoing water development project as well as to relate the goals to other studies of social indicators. The four goals are Cultural and Community Opportunity, Aesthetic Opportunity, Recreational Opportunity, and Collective Security. During the research several issues and problems are identified which point up inadequacies, not only with Techcom but with many other assessment approaches. Techcom was especially found to lack inputs from sociological and psychological perspectives and this research led to suggested changes in the definition of concepts and types of measurement procedures which might help remedy this deficiency. The Techcom framework needs further testing, the development of improved social data methodology, and the inclusion of subjective data to bring it closer to real societal objectives. However, it is a beginning to a much needed new generation of planning and evaluation techniques.
W79-04491

6B. Evaluation Process

RECREATION BENEFITS OF WATER QUALITY: ROCKY MOUNTAIN NATIONAL PARK, SOUTH PLATTE RIVER BASIN, COLORADO,
Colorado State Univ., Fort Collins. Dept. of Economics.
R. G. Walsh, R. K. Ericson, J. R. McKean, and R. A. Young.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 733, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Inst., and Tech., Report No. 12, May 1978. 140 p, 7 fig, 16 tab, 88 ref, 3 append. OWRT B-042-COLO(4), 14-31-0001-3065.

Descriptors: *Water quality, *Recreation, *Recreation demand, *Rocky Mountain National Park, *South Platte River Basin(Colorado), *National Parks, Economics, Cost-benefit analysis, Cost benefit ratio, Water pollution, Water pollution effects.

A random sample of 141 households were interviewed in Rocky Mountain Natonal Park during the summer of 1973 as part of a study to develop and apply a procedure for measuring the relationship between water quality and nonresident recreation benefits. Park visitors were requested to rank photographs of water quality according to the perceived amount of pollution contained in the water in each photograph, and then were questioned about their willingness to pay for high quality water for recreational purposes. The question were designed to measure consumer surplus benefits. Willingness to pay was measured in terms of a recreation entrance fee, the value of waterfront property, and travel time. Some of the results included: (1) park visitors were willing to pay more in recreation fees rather than have the water quality decreases; (2) visitors were willing to travel 0.9% more to avoid a change in water quality; (3) income was positively related to willingness to pay an entrance fee for improved water quality; and (4) income was negatively related to willingness to increase travel time; i.e., for every $1,000 increase in income, willingness to travel decreased by 10%. It is concluded that park visitors from industrially developed regions with a dense population would be willing to pay more for water quality in the park. Colorado residents reported that they would be willing to pay about the same rates as non-residents for water quality. (Davison-IPA)
W79-04004

THE ADDITIVE AND INTERACTIVE EFFECTS OF POWERLESSNESS AND ANOMIE IN PRE-

DICTING OPPOSITION TO POLLUTION CONTROL,
Illinois Univ. at Urbana-Champaign.
For primary bibliographic entry see Field 5G.
W79-04010

THE ECONOMIC IMPACT OF INCREASED FOREST AND FARMLAND BEAVER DAMAGE IN MISSISSIPPI,
Mississippi State Univ., Mississippi State. Dept. of Wildlife and Fisheries.
For primary bibliographic entry see Field 2H.
W79-04074

THE EFFECTS OF INLAND NAVIGATION USER CHARGES ON BARGE TRANSPORTATION OF WHEAT,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W79-04075

CONJUNCTIVE GROUND AND SURFACE WATER ALLOCATIONS: THE ECONOMICS OF A QUASI-MARKET SOLUTION,
Colorado State Univ., Fort Collins. Dept. of Economics.
J. Daubert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 992, Price codes: A09 in paper copy, A01 in microfiche. MS Thesis, Fall 1978. 182 p, 22 fig, 15 tab, 79 ref. OWRT B-109-COLO(8), 14-31-0001-4067.

Descriptors: Groundwater, *Water allocation, Water management, Pumping, Surface water, Water policy, *Conjunctive use, South Platte River Basin.

This thesis compares the net farm benefits and corresponding ground and surface water allocation under an augmentation plan; an unrestricted pumping policy; a system which prevents pumping; and pumping quotas. Any change from the historical open access policy generates a gain to surface water right owners, a loss to those who must curtail their pumping, and an administrative cost. The goal is to determine the water resource policy that maximizes the net social benefits. A computer simulation model incorporating the legal, hydrologic and economic characteristics of the lower South Platte River Basin in Colorado evaluates the policies. In the legal submodel, surface water allocations must comply with the prior appropriation doctrine. The hydrologic submodel represents the physical interrelationships between a stream and aquifer. The economic submodels represent the intermediate and short-run farm decision making process. An intermediate model uses an expected income-variance model to determine the planted acreage of each crop. The short-run model allocates available surface and groundwater between crops according to a profit maximizing motive. The simulation combines all submodels to predict the net income for each alternative conjunctive water use policy. Comparing the simulation results of a policy which prohibits pumping and an open access policy indicates that groundwater withdrawals are responsible for much of the area net income. Unrestricted groundwater use increases the predicted net benefits from $11.3 to 33.1 million. However, during a year where river flows are below average pumping causes a significant depletable externality. Pumping, by reducing surface flows, reduces the income of farmers that use senior surface water rights by 39 percent. The most efficient simulated conjunctive use water policy is augmentation plans which generate the largest area net benefits, $36.4 million, and eliminate any loss to senior surface users.
W79-04078

UNCERTAINTY IN WATER RESOURCE PLANNING IN THE CONNECTICUT RIVER BASIN,
Massachusetts Univ., Amherst. Water Resources Research Center.
E. R. Kaynor.
Water Resources Bulletin, Vol. 14, No. 6, p 1304-1313, December 1978. 21 ref. OWRT C-7178(No 6215)(1), 14-34-0001-6215.

Descriptors: *Risks, *Planning, *Water resources planning, *Theoretical analysis, *Evaluation, *Flood control, *Interbasin transfers, *Diversion, *Navigation, *Connecticut River.

Four ways of dealing with uncertainty in the resource planning process have been prescribed: to reduce it, to ignore it, to avoid it, and to convert it to risk as chance of occurrence for calculation in planning. This paper analyzes examples of water resource planning in the Connecticut River Basin to confirm, reject, or modify these prescriptions. The examples of planning chosen for analysis are navigation, flood control, and interbasin diversion for water supply. These confirm the desirability of reducing uncertainty, offer some support for strategies to avoid it and to convert it to risk, but do not support the desirability of ignoring it. (Godfrey-Mass)
W79-04082

ECONOMIC ANALYSIS OF THE CONJUNCTIVE USE OF SURFACE WATER AND GROUND WATER OF DIFFERING PRICES AND QUALITIES: A COMING PROBLEM FOR ARIZONA AGRICULTURE,
Arizona Agricultural Experiment Station, Tucson.
M. A. Boster, and W. E. Martin.
Technical Bulletin 235, 1977. 36 p, 8 fig, 19 tab, 38 ref, 1 append. OWRT A-048-ARIZ(4).

Descriptors: *Water supply development, *Colorado River, *Water transfer, Computer models, Agriculture, Water requirements, Irrigation, Economics, Water costs, Water quality, Salinity, Groundwater, Surface waters.

An economic evaluation of the adjustment alternatives open to irrigated agriculture in the proposed service area of the Central Arizona Project (CAP) in Pinal County, Arizona, is reported. The CAP involves the construction of an aqueduct to transport water from Lake Hauasu on the Coloredo River into the Maricopa County-Phoenix area through Pinal County to Tucson. Colorado River water contains different dissolved-salt concentrations than the groundwater and the surface water currently being used. Some areas of Pinal County have low salinity ratios, while others have a high salinity ratio; the optimum CAP-local water mix for typical crops was determined through the use of linear programming models. Each model includes alternative crop production activities using various quantities and mixes of CAP water and local surface groundwater. The models were designed to maximize net farm returns. The basic conceptual issues involved are discussed, Pinal County is described in detail, and results of analyses of alternative management scenarios are presented. (Davison-IPA)
W79-04104

REPORT ON CIBOLA DIVISION (6) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact and Research.
G. W. Greey, A. Jaten, and G. W. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-289 120, Price codes: A07 in paper copy, A01 in microfiche. June 1978. 142 p, 1 fig, 91 tab, 3 append. 14-06-300-2532.

Descriptors: *Recreation, *Colorado River, *Cibola Division(6), *Surveys, On-site data collections, Fishing, Swimming, Water skiing, Boating, Camping, Recreational demand.

An inventory to determine visitor levels and participation patterns on the Cibola Division (6) of the Lower Colorado River was conducted January 1, 1975 through December 31, 1975. This section of the Lower Colorado River is located between the Old Adobe Ruin site and the California Riverside and Imperial County line, and covers a 23.7 mile length. Study and analyses with on-site observations were done at 17 sites, for a total of 1,018 observations. Over the survey period 64,035.50 recreational vehicles visited the area; the total number of visitors was 321,186.20 Camping and picnicking had the greatest number of participants, 170,657.20. Water based activities accounted for 37% of the total participation, with fishing (48,217), motor boating (32,238), and swimming and tubing (25,256.50) having the major portion of water related participation. Results of the data show that most of the use occurred at the intersection of Oxbow Lake and the river channel, and the Walters Camp site. Although some visitors were local residents, the major users of this division were non-residents: the highly mobile transients, and visitors from the California coastal area. (Davison-IPA)
W79-04105

REPORT ON IMPERIAL DIVISION (7) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
G. W. Greey, A. Jaten, and G. W. Cheatham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 956, Price codes: A07 in paper copy, A01 in microfiche. July 1978. 132 p, 2 fig, 85 tab, 3 append. 14-06-300-2532.

Descriptors: *Recreation, *Colorado River, *Surveys, *Imperial Division(7), On-site data collections, Fishing, Swimming, Water skiing, Boating, Camping, Recreation demand.

An inventory to determine visitor levels and participation patterns on the Imperial Division (7) of the Lower Colorado River was conducted January 1, 1976, through December 31, 1976. This section of the Lower Colorado River is located between the Old Adobe Ruin site and the Imperial dam, and covers a 37.3 mile length. Study and analyses with on-site observations were done at 16 sites, where a minimum of six weekend and three weekday observations were made for four, three month periods. Over the survey period 46,414.000 recreational vehicles visited the area; the total projected number of visitors was 135,567.50. Camping (149,575.50) and picnicking (77,748.00) accounted for 92.8% of the total land based participation. Water related activities accounted for 52.6% of all visitor participation with motor boating (95,620.50), swimming (71592.50), fishing (54,831.50), and water skiing (28,743.50) having the major portion of water related participation. Results of the data show that participation is varied and is predictable in some areas. The majority of visitors to the area are local residents, transient visitors and southern California coastal residents; varying percentages of each group were attracted to different areas. (Davison-IPA)
W79-04106

REPORT ON LAGUNA DIVISION (8) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
G. W. Greey, A. Jaten, and G. W. Cheatham.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-288 893, Price codes: A04 in paper copy, A01 in microfiche. 1978. 64 p, 1 fig, 31 tab, 3 append. 14-06-300-2532.

Descriptors: *Recreation, *Colorado River, *Laguna division(8), *Surveys, On-site data collections, Fishing, Water utilization, Swimming, Natural resources, Recreation demand, Camping.

An inventory to determine visitor levels and participation patterns on the Laguna Division (8) of the Lower Colorado River was conducted January 1 through December 31, 1976. This section of the Lower Colorado River is located between Imperial Dam and Laguna Dam, and covers a 5.4 mile

length. Study and analysis with on-site observations were done at five sites, where a minimum of six weekend and three weekday observations were made for four, three month periods. Over the survey year 68,614.50 recreational vehicles visited the area; the total projected number of visitors was 127,140.10. Camping (127,140.10) and picnicking (26,195.00) accounted for 97.9% of the total land based participation; water related activities, limited to fishing and swimming, had 43,680.30 participants. Results of the data indicate that the major group visiting the area was transient in nature, in that they migrate from one geographic area to another seasonally, with the majority present during the temperate months. (Davison-IPA)
W79-04107

INTERIM REPORT, SOUTH UMPQUA RIVER. TRANSCRIPT OF PUBLIC MEETINGS.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 543, Price codes: A99 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, February 1972, Transcripts of meetings held at Roseburg, Oregon, 28 October 1971.

Descriptors: *Planning, *Water resources development, *Water resources planning, *Reservoirs, *Watershed management, *Public participation, *Umpqua River(OR), *South Umpqua River(OR), *Days Creek(OR), *Public meetings, Oregon, Public access, Multiple-purpose projects, Water supply, Recreation, Flood control, Irrigation, Public agencies, Citizens, News media, Businesses, Private organizations.

This volume contains transcripts of public meetings held in Roseburg, Oregon on 28 October 1971, held in conjunction with a plan for the solution of water resource problems in the area drained by the South Umpqua River, in the Umpqua River Basin. Two meetings were involved, and each transcript records attendance, participants, transcripts of oral statements and statements on written attendance cards. Discussion centers around the construction of the Days Creek dam and development of the storage facility on Days Creek. The Army Corps of Engineers' District Engineer sets out the details of the proposed development, and discussion from those in attendance follows. The final section is a presentation of exhibits. Included in the exhibits are statements and letters from public agencies, and statements and letters from individuals, businesses, news media, and private organizations, both favoring and opposing the Days Creek Dam and Reservoir Project. (Zayac-NC)
W79-04142

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N.
Big Muddy River Coordinating Committee, IL.
For primary bibliographic entry see Field 6D.
W79-04144

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI. VOL. 1, MAIN REPORT.
White River Basin Coordinating Committee.
For primary bibliographic entry see Field 6G.
W79-04146

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI. VOL. VI: APPENDIX P - PLAN FORMULATION.
White River Basin Coordinating Committee.
For primary bibliographic entry see Field 6G.
W79-04147

HILL REESTABLISHMENT: RETROSPECTIVE COMMUNITY STUDY OF A RELOCATED NEW ENGLAND TOWN,
New Hampshire Univ., Durham. Water Resources Research Center.
S. P. Adler, and E. F. Jansen, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A058 220, Price codes: A11 in paper copy, A01 in microfiche. May 1978. 229 p, 11 appendices, 14 fig, 2 tab, 19 photos, IWR Contract Report 78-4. DACW 33-77-C-0077.

Descriptors: *Water resource management, *Economic impacts, *Social impacts, *Relocation, *Hill(NH), *Danbury(NH), Political impact, Regional planning, Sites, Property values, Methodology, Surveys, Flood control, Reservoirs, Attitudes, New England, Tax base, Social costs, Trend analysis, Attitudinal analysis, Impact assessment.

This study examines the relocation of Hill, NH in 1940 and determines the socioeconomic impact of the relocation on the town. Two flood control projects built by the Army Corps of Engineers necessitated relocation of the town. The study is divided into 6 section: (1) the town's background and history; (2) overall impacts of the relocation; (3) social impacts; (4) economic impacts; (5) political impacts; and (6) processes and techniques used in relocating Hill. The study includes a descriptive narrative which elucidates relevant indicators that represent the impacts upon the relocated families, the community as a whole, and the region. Social, political, and economic impacts were examined over 3 time periods--prelocation, relocation-construction, and post-relocation. Different methodologies are combined into three basic analyses to measure and describe different dimensions of the relocation: (a) an archival search; (b) a trend analysis; and (c) a questionnaire-attitudinal study of the existing community. A trend analysis of social and economic indicators showed that fluctuations in population, tax base, commercial enterprises, etc., paralleled that of other communities in the area. Decreases in indicators such as population were short term. Findings indicate that local involvement in the relocation process played an important role in the success of the project. Appendices list those contacted for information, financial aspects of the relocation, questionnaire findings, a chronology of events, articles describing the relocation process, minutes from public meetings, letters, and possible indicators for trend analysis. (Coan-NC)
W79-04158

WATER SYSTEMS COUNCIL: A VARIETY OF SERVICES TO PUMP MANUFACTURERS AND THE WATER WELL INDUSTRY,
For primary bibliographic entry see Field 4B.
W79-04240

HEAT PUMP UPDATE.
Water Well Journal, Vol 33, No 1, p 45, January 1979. p 45, 1 tab.

Descriptors: *Ground water, *Heat pumps, *Cost analysis, Air conditioning, Space heating, Water heating.

Energy usage with monthly and daily costs are listed for a ground water source heat pump being monitored by the National Water Well Association in central Ohio. The costs are for heating/cooling and hot water generation. During June through September, only the air conditioning mode was used. The average monthly cost was $27.77 or $.91 per day. Compared to an electric resistance water heating system the heat pump system uses 40% less energy while simultaneously providing air conditioning requirements. (Purdin-NWWA)
W79-04246

WATER WELLS HELP TEXAS CITY SAVE MONEY.
Water Well Journal, Vol. 33, No. 1, p 46, January 1979.

Descriptors: *Water resources development, *Water wells, *Suburban areas, Groundwater resources, Bond issues, Texas.

Irving, Texas will save $430,000 in water supply costs under a 10-year contract with Whalen Corp., a water resources technology firm. Four wells will be reworked, one at a time, to raise their capacity from 4.3 mgpd to 5.76 mgpd, or 19% of Irving's total maximum capacity. College Station is also under a contract with Whalen Corp. which supplies 30 to 40% of its water needs, at a rate 25% lower than a neighboring community. The contract requires that the city pay only for the water it uses. At the end of the contract period the wells will become the city's property for a small fee. This type of contract offers an alternative method to using valuable bond money for municipal improvements and avoids years of delay involved in obtaining bond funds. (Purdin-NWWA)
W79-04247

PERSPECTIVES ON DESERTIFICATION,
New South Wales Univ., Kensington (Australia).
For primary bibliographic entry see Field 3F.
W79-04282

TECHNOLOGY, REGIONAL INTERDEPENDENCE, AND POPULATION GROWTH, TUCSON, ARIZONA,
Arizona Univ., Tucson.
A. W. Wilson.
Economic Geography, Vol. 53, No. 4, p 388-392, Oct. 1977. 7 ref.

Descriptors: *Community development, *Arizona, *Groundwater availability, *Regional analysis, *Regional development, Human population, Ecology, Environmental effects, Social aspects, City planning, Urban sociology, Arid lands, Regional economics, Water supply, Resource allocation, Social aspects.

Desertification presents a unique problem in the Sonoran Desert of Arizona for here aridity is an attractive asset to most of its inhabitants. The human development of the Sonoran Desert is typified by the city of Tucson and its special attributes which include: (1) a close connection with the rest of the U.S., (2) a unique natural environment in which to live or visit, (3) avoidance of food production problems, and (4) an increasing insulation in this highly technological society from other burdens of an occasionally harsh environment. The focus of this analysis: how to define desertification when aridity is an asset rather than a liability, is a discussion of Tucson's groundwater problems, population growth, environmental consciousness, and livelihood patterns. How to make the best use of the most important limiting resource, water, has been the major consideration as this artificial, humanized environment has been imposed upon the natural desert ecology. It is argued, however, that the economic growth of the Tucson Basin has demonstrated that wise application of technology not only can triumph over the limited productive potential of an arid area but also can counteract or avoid any degradation in the region's natural ecology. (Tickes-Arizona)
W79-04307

NATIONAL FORESTS DO NOT HAVE RESERVED WATER RIGHTS FOR RECREATIONAL PURPOSES,
For primary bibliographic entry see Field 6E.
W79-04417

A NONLINEAR PROGRAMMING ALGORITHM FOR REAL-TIME HOURLY RESERVOIR OPERATIONS,
California Univ., Los Angeles. Dept. of Engineering Systems.
W. S. Chu, and W. W-G. Yeh.
Water Resources Bulletin, Vol. 14, No. 5, p 1048-1063, October 1978. 2 fig, 3 tab, OWRT C-7099(No 6209)(2), 14-34-0001-6209.

Descriptors: *Optimization, Operations Research, *Computer programming, Multiple purpose projects, *Reservoir operations, *Hydroelectric power, Mathematical studies, Model studies.

The optimization of real-time operations for a single reservoir system is studied. The objective is to maximize the sum of hourly power generation

over a period of one day subject to constraints of hourly power schedules, daily flow requirement for water supply and other purposes, and the limitations of the facilities. The problem has a nonlinear concave objective function with nonlinear concave and linear constraints. Nonlinear Duality Theorems and Lagrangian Procedures are applied to solve the problem where the minimization of the Lagrangian is carried out by a modified gradient projection technique along with an optimal step-size determination routine. The dimensions of the problem in terms of the number of variables and constrainsts is reduced by eliminating the 24 continuity equations with a special implicit routine. A numerical example is presented using data provided by the Bureau of Reclamation, Sacramento, California. (Snyder-Calif Davis)
W79-04482

PERCEPTIONS OF EFFECTIVE PUBLIC PARTICIPATION IN WATER RESOURCES DECISION MAKING AND THEIR RELATIONSHIP TO LEVELS OF PARTICIPATION,
Purdue Univ., Lafayette, IN. Dept. of Sociology and Anthropology.
H. R. Potter, and H. J. Norville.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-292 336, Price codes: A03 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No. 115. January 1979. 42 p, 38 tab, 51 ref, 1 append. OWRT A-043-IND(1).

Descriptors: *Decision making, Social aspects, Social values, Social function, *Citizens participation, *Public participation.

The report focuses on how citizen participants perceive the effectiveness of their participation in natural resources decision making, comparing very, moderately and slightly active participants. Data are from personal interviews with 77 very and moderately active persons, and from mailed questionnaires to 106 moderately and slightly active participants from throughout Indiana. The operational measure of extent of participation used for data analysis was hours per week spent on environmental activities, which had a fairly strong relationship to other indicators of participation. Participants generally viewed their participation as effective, on a series of measures. Very active citizens were more effective than slightly active participants; they also used more participation techniques more often than the slightly active participants. Most effective techniques involved direct contact with decision makers, the press and others, and knowledge of issues. Public hearings, advisory boards, courts and lawyers, bumper stickers and buttons, and protest demonstrations were considered much less effective. They felt governmental agencies are changing, and becoming more responsive. Very active participants tended to have more positive views of agencies, particularly of state and federal agencies. Most participants saw no financial benefits associated with participation, although many saw losses, often associated with the costs of participation.
W79-04493

WATER SYSTEMS AND THEIR EMERGENCIES,
California Univ., Irvine. School of Engineering.
G. Urbach, R. Schinzinger, T. Edwards, and H. Fagin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 416, Price codes: A04 in paper copy, A01 in microfiche. Emergency Water Allocation Project Working Papers No 12, 13 and 14, 1978, 101 p, 21 fig, 5 tab. (California Water Resources Center Project UCAL-WRC-W-498). OWRT B-178-CAL(7).

Descriptors: *Water shortage, *Water supply, *Rationing(Water), Water management, Disasters, Accidents, Earthquakes, California.

The Emergency Water Allocation Project (EWAP) at the University of California at Irvine has been working for the past three years on a systematic approach to the development of an effective Water Emergency Response System. The site for pursuing and applying these investigations has been the San Diego region, an area considered representative of many growing urban areas which import most of their water from outside sources. Described are the methods developed to identify vulnerable aspects of a water system, and to introduce a systematic emergency preparedness process. A conceptual model of the water system and its operating environment is presented and steps necessary to implement an emergency allocation plan for scarce water and restoration resources are reviewed. Methods are described for analyzing the vulnerability of a network and for pinpointing critical elements that warrant strengthening or for which redundant paths should be provided. An Emergency Resources Directory for use by member agencies of the San Diego County Water Authority is included. (Snyder-California)
W79-04497

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE EFFECTS OF INLAND NAVIGATION USER CHARGES ON BARGE TRANSPORTATION OF WHEAT,
Purdue Univ., Lafayette, IN. Dept. of Agricultural Economics.
J. K. Binkley, J. Havlicek, Jr., and L. A. Shabman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 993, Price codes: A06 in paper copy, A01 in microfiche. Virginia Polytechnic Institute and State University, Blacksburg. Research Division Bulletin 137, 1978. 107 p, 4 fig, 14 tab, 46 ref, 2 append. OWRT B-082-VA(2).

Descriptors: *Use rates, Navigation, Inland waterways, *Transportation, Costs, Wheat.

This study evaluated the effect of inland navigation user charges on barge wheat movements on both the Mississippi River system and particular segments of the system. Transshipment models were constructed, examining three wheat varieties: hard red spring, hard red winter, and soft red winter. The models permitted two types of movements from producing to consuming areas: direct movements or movements through river transshipment points. This allowed the models to choose between barge transportation and competitive modes. Consuming regions were comprised of domestic milling points and foreign countries. Exports to any given point were allowed to move through any of several U.S. ports, depending upon relative transport costs. This gave the models a great deal of flexibility in the export sector, which is critically important for barge transportation of wheat. Data used included 1970-71 wheat production and consumption, and 1975 barge and rail rates, truck costs, and handling costs for each mode. User charges were based on 1974 operation and maintenance costs of the inland waterway system and 1974 barge ton-miles. Base solutions were obtained for each of the models, and then each was run with user charges recovering from 25 to 500 percent of annual operation and maintenance. The effects of uniform charges and charges specific to each waterway were examined. Results were: (1) Few wheat movements were significantly affected by uniform charges recovering 100% of costs, with a moderate reduction in total barge wheat traffic, (2) specific charges seriously reduced wheat traffic on certain high cost rivers, but brought about a moderate reduction of wheat movements on the total system.
W79-04075

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME II, APPENDIX A: ECONOMIC DATA AND ANALYSIS.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 961, Price codes: A10 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, December 1971. 140 p, 46 tab, 15 fig, 4 plates, 19 photos, one of 5 volumes.

Descriptors: *Water resources development, *Multiple-purpose reservoirs, *Economics, *Cost-benefit analysis, *Planning, *Water quality, *Umpqua River(OR), *South Umpqua River(OR), Oregon, Cost comparisons, Flooding, Flood damage, Benefits, Fish management, Recreation, Water quality control, Irrigation, Water supply, Municipal water, Local governments, Industrial water, Construction, Population, Employment, Income, Reservoirs, Non-structural alternatives. Area redevelopment, Housing, Educational facilities, Structural alternatives, Cost repayment.

This Appendix A has as its purpose the summarization of procedures, projections, and basic economic data that would accrue to a multiple-purpose reservoir in the Umpqua River Basin. In the analysis, 1985 was assumed for project year one. The major water resource problems in the area are flooding, caused by too much water in the winter months and too little water in midsummer and fall. This basin's economic base and growth projections are detailed through population, employment, income, and principal industries. A history of the basin's flood problems and an inventory of existing flood problems leads to an average annual damage calculation; future flood damages are projected using earlier growth data. Alternative solutions to the flood problem are reviewed with flood control benefits attached. Benefits attached to a number of other purposes are then studied: recreation, fishery mitigation and enhancement, water quality control, municipal and industrial water supply, irrigation, and area development. A net benefit maximization model is developed, and results of the maximization study are presented. Costs are then evaluated in a cost-benefit analysis. Final cost allocations are made, and repayment methods are suggested. A last chapter details local economic effects during construction by looking at characteristics of the local economy, construction employment and expenditures, population and income effects, and impacts upon population, housing, educational facilities, and local governments. (Zayac-NC)
W79-04140

WATER WELLS HELP TEXAS CITY SAVE MONEY.
For primary bibliographic entry see Field 6B.
W79-04247

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 6E.
W79-04425

THE USE OF CIVIL PENALTIES IN ENFORCING THE CLEAN WATER ACT AMENDMENTS OF 1977,
For primary bibliographic entry see Field 6E.
W79-04449

6D. Water Demand

A CROSS-SECTIONAL INVESTIGATION OF THE DETERMINANTS OF URBAN RESIDENTIAL WATER DEMAND IN THE UNITED STATES, 1960 AND 1970,
Texas A and M Univ., College Station. Water Resources Inst.
H. S. Foster, Jr., and B. R. Beattie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 714, Price codes: A04 in paper copy, A01 in microfiche. Technical Report-86, May 1978. 60 p, 4 fig, 8 tab, 34 ref, 1 append. OWRT A-999-TEX(7).

Descriptors: *Water demand, *Municipal water, *Cities, *Model studies, Mathematical models, Economics, Water rates, Planning, Estimating, Economic impact, Statistics, Least squares method, Regression analysis.

An economic model was developed relating residential demand for urban water to its determinants. Theoretical and statistical properties of alternative models were considered in selecting the variables and specifying the functional form of the model. Parameters of the model were estimated on the basis of pooled data representing a cross section of U.S. cities. Dummy variables were incorporated to estimate a regionalized version of the model, and for estimates of size of city effects. The hypothesis, water demand is invarient among regions, was tested and rejected; the hypothesis, water demand is invariant among size-of-city categories, could not be rejected. The models were fitted using 1960 and 1970 data and ordinary least squares regression techniques; the explanatory variables, price, income, precipitation (during the growing season), and the number of residents per meter, were included. Income and price elasticities are given for all regions at the mean price level and for one standard and deviation above and below the mean price level. (Davison-IPA)
W79-04003

MULTIPLE USE OF IRRIGATION CANALS,
Utah State Univ., Logan. Coll. of Natural Resources.
J. J. Kennedy, and S. Morgan.
Utah Science, Vol. 36, No. 2, p 71-73, June 1975. 3 fig. OWRT-A-017-UTAH (3).

Descriptors: *Canals, *Recreation, *Cache Valley(Utah), *Legal aspects, Public access, Management, Fishing, Fisheries, Adverse possession, Wastes, Recreational wastes, Litter.

Irrigation canals in Cache Valley, Utah, are filling the recreational needs of a large section of the population consisting of children and senior citizens. The multiple uses of the canals have generated conflicts between the canal owners, the recreational users, and landowners adjacent to the canals. In some areas, landowners monopolize sections of the canals, excluding the public, and depositing large amounts of trash in the form of grass and shrubbery clippings in the canals. Recreational users contribute a small amount of refuse to the canals, and some citizens groups are concerned about the accidental drownings that occasionally occur. The canal companies have thus far maintained the canals, but the problems of liability for recreation users and the implications for canal management is becoming increasingly important. It is suggested that cooperative agreements between canal companies and public agencies may shift some of the management and maintenance responsibility to the public. It is reported that unless cooperative action is taken, the canal companies may restrict the general public's use of the canals. (Davison-IPA)
W79-04096

ENERGY AND WATER RESOURCES.
Oregon State Univ., Corvallis. Water Resources Research Inst.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 887, Price codes: A06 in paper copy, A01 in microfiche. January 1977. Fall Quarter Seminar, 1976. 122 p, 44 fig, 32 tab, 47 ref. OWRT-A-999-ORE(22).

Descriptors: *Water resources, *Water management(Applied), *Oregon, *Energy, Water requirements, Conservation, Agriculture, Solar radiation, Irrigation, Thermal water, Hydroelectric plants, Columbia River Basin, Pacific Northwest, Waste water treatment, Diversion, State government, Regional development, Planning.

A compilation of papers from a weekly series exploring some issues involving water needs and energy development is presented. The Water Resources Research Institute on the Campus of Oregon State University serves the state in fostering, encouraging and facilitating water research; it administers and coordinates multidisciplinary state and regional reseach programs in water and related land resources. Topics covered are: water requirements for energy development; energy, water resources, and agriculture; energy conservation in irrigation; geothermal energy and water resources; solar energy and water resources; hydro-power and pumped storage in the Northwest; energy and water diversion; energy consumption of advanced waste water treatment; and the impact of irrigation on the Columbia River. (Davison-IPA).
W79-04112

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, SUMMARY REPORT.
Big Muddy River Basin Coordinating Committee, IL.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 946, Price codes: A09 in paper copy, A01 in microfiche. May 1971. 116 p, 8 fig, 11 tab, 3 plates, 2 exhibits.

Descriptors: *Big Muddy River Basin(IL), *Regions, *River basin development, *Agricultural watersheds, *Forest watersheds, *Watersheds, *Watershed management, Water resources development, Water supply, Water allocation(Policy), River flow, Flow augmentation, Floods, Water quality, Planning, Land use, Conservation, Environmental control, Reservoirs, Illinois, Recreation.

This study was undertaken to establish a comprehensive plan to encourage conservation, development and optimum use of the Basin's water and land resources. It examines the needs for comprehensive plan formulation and development for the 10-county area in extreme southern Illinois. The area is expected to remain rural in character over the next 50 years, with mining and agriculture being the major industries. Evaluation between projected demands and existing or planned supplies indicated four overall categories of needs requiring resource management and/or development--agricultural enhancement; low flow stream management; recreation combined with area redevelopment; and environmental control. Action programs were proposed for each category, including developments for agricultural enhancement designed to control floodwater on farmland; programs to maintain stream quality and flow quantity, and a program to maintain a minimum base flow in areas which could suffer from objectional sanitary conditions over time; establishment of outdoor recreational opportunities to meet state and local needs, and to enhance the area's economic base; and an environmental control program designed for preservation of historic and archaeologic sites, conservation of wildlife habitats, improvement and protection of public health, and rehabilitation of strip-mined areas. Recommendations included an immediate Corps of Engineers Basin-wide study of strip-mining problems; implementation of proposed structural and non-structural improvements, including construction of reservoirs, improvement of stream corridors, and land treatment programs; and incorporation of appropriate elements of the Basin Plan into programs of involved federal, state and local agencies. (Arnold-NC)
W79-04143

BIG MUDDY RIVER COMPREHENSIVE BASIN STUDY, ILLINOIS, VOL. 7, APPENDIX M AND N.
Big Muddy River Coordinating Committee, IL.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 945, Price codes: A10 in paper copy, A01 in microfiche. Appendix M: Plan Formulation, 118 p, 32 tab, 3 fig, 4 plates, formal comments. Appendix N: Benefit Evaluation, 30 p, 14 tab, formal comments. 1970.

Descriptors: *Big Muddy River Basin(IL), *River basin development, *Regional economics, *Economic benefits, *Water resources development, *Watershed management, Water supply, Water quality, Cost-benefit analysis, Environmental corridors, *Outdoor recreation, Illinois, Recreation, Recreation development, Planning, Land use, Flood control, Environmental quality, Land treatment.

This study was undertaken to establish a comprehensive plan of development for the Basin's water and land resources of the Big Muddy River Basin, a 10-county area in Southern Illinois. Appendix M examines the plan formulation process. Basin needs and planning goals and objectives are presented, followed by a discussion of the solutions considered. Needs include flood control, land management and treatment, low-flow augmentation, outdoor recreation, wildlife conservation, and environmental quality control. Recommendations to meet the needs of the Basin include structural improvements such as reservoirs, levees, and channelization for flood control; flood plain zoning; at source treatment of effluents to improve water quality; increased recreation development; and the need for consideration of proper conservation programs for the Basin. Benefit-cost ratio data were formulated on the basis of potential growth in recreation opportunities. Recreation is seen as a major growth industry in the area, and portions of the Basin are proposed as Special Recreational Environmental Corridors, suitable for development chiefly for outdoor recreation activities. Appendix N attempts to quantify needs of the Basin to be fulfilled if it is to achieve its growth potential. National account benefits and regional account benefits for the various programs are set out in detail. Of the total benefits, 44% are national in character, basically derived from flood control measures. The remaining 56% of the projected benefits are to be derived by the localities from growth in response to development of new water-related projects. (Arnold-NC)
W79-04144

PLANNING FOR WATER RESOURCES,
Thames Water Authority, London (England).
D. Perret.
Long Range Planning, Vol 10, No 2, p 65-72, April 1977, 8 fig, 2 tab, 7 ref.

Descriptors: *Water management(Administrative), *Thames Water Authority, *England, *Wales, *Water policy, *Planning, *Water resources, *Water resources development, *Administration, Multiple use policy, Water law, Economics, Models, Water demand, Water supply.

This article recounts the history of water resource law and administration in England and Wales from 1945 to the present estsablishment of 10 regional water authorities to deal with water planning from a multiple purpose standpoint. The Thames Water Authority is described as an example. The Authority consists of a board, 6 resource committees, a quality advisory panel, and separate finance and personnel subcommittees. Actual management of day-to-day administrative operations and water resource planning are carried out through the separate Thames Water Management structure and planning organization, respectively. The planning organization is composed of the Strategic Plan Group, which determines planning goals and produces a Strategic Plan for water resources; the Development Plan Group, which assembles and evaluates proposals; the Economic Studies Group, which prepares economic forecasts and analyses of the demand for Authority services; the Central Information Group, responsible for managing information exchange within the Authority and for producing the Authority's reports; the Operational Research Group, charged with analyzing Authority policy; and the Water Resources Group, a subgroup of the Operational Research Group, which evaluates future options for water resources and makes final recommendations to the Authority using a model of the present water resource system. The Authority needs the aforementioned administrative/management framework to cope with Britain's water quantity problems, particularly those arising from recent droughts. Consideration of the relative merits of different proposals and their interaction, given the many complexities involved, will require the use of multimaterial modelling. (Arnold-NC)
W79-04152

YOU NEVER MISS THE WATER ... TILL THE WELL RUNS DRY,
S. M. DeForge.
Dun & Bradstreet Reports, p 16-25, September

1977.

Descriptors: *Water shortage, *Water quality, *Desalination, Water treatment, Water conservation, Water management, Water pollution, Water supply development, Water utilization, Irrigation, Industrial water, Saline water intrusion, Pipelines, Coal mines, Safe Drinking Water Act, Distillation, Membrane processes, Crystallization, Icebergs.

Facts and statistics related to the availability and utilization of water resources both in developed and underdeveloped regions around the world are presented. Problems of increased consumption of water for irrigation, salt water intrusion, unequal distribution of water, and industrial pollution are overstraining over freshwater supplies. New techniques to conserve, manage and distribute surface and ground-water supplies include: diversion of rivers; 'trickle' irrigation; covering soil and reservoirs with a film to retard evaporation; underground storage; and recycling used water. Energy-related industries consume enormous amounts of water. 'Coal slurry' pipelines are a threat to the water resources of the Rocky Mountain states since one ton of water is needed to transport one ton of coal. The implementation of the Safe Drinking Water Act of 1974 by the E.P.A. should effect the improving of water treatment systems, regular sample analyses for bacterial and chemical content, and enforcement of water-quality standads. Various water-treatment processes are described. Three methods of desalination; distillation, membrane process, and crystallization are compared. Presently, desalination is feasible only in oil-rich nations. Alternatives to desalination are towing icebergs from Antarctica or filling empty oil tankers with fresh water. (Purdin-NWWA)
W79-04244

WATER SYSTEM DESIGN FOR A LOW YIELD WELL,
Hanson Drilling Co., Inc., Vancouver, WA.
For primary bibliographic entry see Field 8A.
W79-04250

AGRICULTURE: ITS HISTORIC AND CONTEMPORARY ROLES IN ARIZONA'S ECONOMY,
Arizona Univ., Tucson. Dept. of Geography.
M. E. Hecht, R. W. Reeves, and N. De Gennaro.
Arizona Review, Vol. 27, No. 11, p 7-12, November 1978. 1 fig, 1 tab.

Descriptors: *Agriculture, *Regional economics, *Economic impact, Crop production, Arable land, History, Land use, Livestock, Employment opportunities, Soils, Water resources development, Water shortage, Water allocation(Policy), Arizona.

The agricultural history, natural resources, climate and settlement patterns of Arizona are described in this analysis in order to put Arizona's past and present agricultural development in perspective. Although farming has long been an important industry in Arizona as evidenced by the fact that today more than half of state land is used for agricultural production, it is important to point out that much of this is used for low intensity livestock ranching, with crop production accounting for only 2% of the land use. Employing only 2.3% of the state's workers, crop production is by far the major consumer of the state's most critically limited resource: water. Three elements of the state's natural environment, water, soil and climate, are the most influential factors determining the course of the state's agriculture with water being the most limiting factor. This examination of the role of agriculture, both today and in the past, is helpful in explaining the position of the farmer in the complex problem of the state's water resource allocation. Trends emerging from this analysis are: (1) while other state industries have experienced rapid growth, agriculture has continued without major economic growth or locational changes, (2) the number of people employed by this industry, (3) losses slightly declining although crop acreage has shown a moderate increase, (3) losses in farmland to urban expansion has been compensated for by growth on the peripnery and in the Yuma area, and (4) changes in crop acreage have reflected changing market conditions, with cotton and cattle presently the principal commodities. (Tickes-Arizona)
W79-04281

POTENTIAL POTABLE-WATER SUPPLIES IN REDWOOD NATIONAL PARK,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. P. Akers.
Available from OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225 paper copy $4.50, microfiche $3.50. Geological Survey open-file report 78-970, November 1978. 27 p, 12 fig.

Descriptors: *Groundwater, *Water quality, *Water supply, *Evaluation, *National parks, Groundwater availability, Potable water, California, *Redwood National Park.

An evaluation was made of the potential for potable-water supplies at 13 sites in or near Redwood National Park, Calif. The National Park Service is planning the development of visitor facilities at these sites. At some sites, locations are given for test-well drilling or springs are recommended for development. Chemical analyses of water from selected surface-water supplies and from some wells and springs show that the water is suitable in most places, although concentrations of iron and chloride are excessively high in some areas. (Woodard-USGS)
W79-04393

CALIFORNIA V. UNITED STATES (STATE RESTRICTIONS ON FEDERAL APPROPRIATION OF WATER UPHELD),
98 S. Ct. 2985-3011 (1978).

Descriptors: *Permits, *Federal-state water rights conflicts, *Appropriation, *Federal reclamation law, Impounded waters, Dams, Water distribution(Applied), California, Arid lands, Water resources, Irrigation, Water allocation(Policy).

The United States Bureau of Reclamation applied to the California State Water Resources Control Board for a permit to appropriate water that would be impounded by the New Melones Dam. Congress specifically directed that the dam be constructed and operated pursuant to the federal Reclamation Act of 1902, which established a program for federal construction and operation of reclamation projects to irrigate arid western land. The Bureau's application was approved, but subject to state imposed restrictions. The United States then brought an action seeking a declaratory judgment that the federal government may impound whatever unappropriated water is necessary for a federal reclamation project without complying with state law. The District Court held that the United States was required to apply for an appropriation permit but that the permit must be issued without conditions if there was sufficient unappropriated water. The Supreme Court reversed. The Court held that, under the 1902 Reclamation Act, a state may impose any condition on control, appropriation, use of distribution of water in federal reclamation project which is not inconsistent with clear congressional directives respecting the project. (Hucks-Florida)
W79-04427

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

UNITED STATES V. STATE OF NEW MEXICO (IMPLIED RESERVATION OF WATER DOCTRINE HELD TO COVER ONLY AMOUNT OF WATER NECESSARY FOR THE PURPOSE OF THE RESERVATION).
For primary bibliographic entry see Field 6E.
W79-04453

6E. Water Law and Institutions

ACTION PROGRAMS FOR WATER YIELD IMPROVEMENT ON ARIZONA'S WATERSHEDS: POLITICAL CONSTRAINTS TO IMPLEMENTATION,
Arizona Univ., Tucson. School of Renewable Natural Resources.
H. J. Cortner, and M. P. Berry.
In: Hydrology and Water Resources in Arizona and the Southwest, Vol. 8, p 45-52, 1978, Proceedings of the 1978 Meetings of the Arizona Section of the American Water Resources Association and the Hydrology Section of the AAS, Flagstaff, AZ, April 14-15. OWRT A-072-ARIZ(4), 14-34-0001-7005 and 7006.

Descriptors: Water yield, Watershed management, Decision-making, Institutions, Arizona, Vegetative modification, Interest groups.

Three successful attempts to implement large-scale action programs for water yield improvement on Arizona's watersheds are described. Two programs were thwarted after release of state-of-the-art research reports, the 1956 Barr Report and the 1974 Ffolliott-Thorud Report, both of which were designed to provide the basis for program implementation. Another ongoing action program involving treatments of pinyon-juniper and chaparral and creation of fuel breaks was halted in progress. The factor which contributed to these failures are examined. These include, for example: overstated program goals; unrealistic assumptions about the political feasibility of treatment types, extent and intensity; failure to recognize the emergence of new decision-making participants; and unsettled questions concerning program costs and beneficiaries.
W79-04093

SPECIAL WATER RIGHTS FOR INDIANS: PRINCIPLE VERSUS CONFUSION,
California Univ., Los Angeles. Dept. of History.
N. Hundley.
In: Navajo Nation Energy Conference, Tsaile, Arizona, May 2, 1977. p 7-13, 1977. Conference Proceedings, LA-6927-C-Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico. (California Water Resources Center Project UCAL-WRC-W-516). OWRT-A-059-CAL(1).

This report provides a measure of historical perspective by sketching the events that led to the U.S. Supreme Court announcement that there is a special Indian water right. The review also offers some reasons for the confusion that continues to surround that right and calls for an equitable, clear resolution. (Snyder-Calif)
W79-04121

ACCOMPLISHMENT PLAN, REGION VIII. COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 454, Price codes: A03 in paper copy, A01 in microfiche. June 1975. 45 p, 5 append.

Descriptors: *Regional planning, *Water quality control, *Energy, *Natural resources, Water pollution, Air pollution, Coal, Uranium, Oil shale, Water resources, Environmental impacts, Water quality management, Montana, North Dakota, South Dakota, Wyoming, Utah, Colorado, 208 areawide planning, Energy resources, Project planning.

One half of the nation's coal reserves, 40% of the economically recoverable uranium reserves, and all commercially feasible oil shale resources are located in EPA Region VIII. The development of these energy resources has significant environmental impacts. Pressures to develop these resources are accelerating. This Accomplishment Plan is a continuation of the FY '74 and '75 Accomplishment plans which focus on the development of

these resources. The plan emphasizes a balanced program incorporating environmental monitoring, technical investigations, control technology evaluation, impact prediction, environmental planning, and regulatory program development. The report lists funding summaries for all aspects of the plan and additional funding needed for new programs. A large section of the report lists major constituents of the FY '76 Regional Management Plan. This includes objectives, output/tasks, funding levels, staff support, and schedules for completion of tasks. Objectives include developing resource monitoring systems; formulating coordinated environmental management plans for high priority impact areas; identifying, monitoring, and coordinating energy research activities; and other goals. Tasks needed to achieve these objectives are listed with funding, scheduling, and needed staff support. The interdivisional functional relationships of organizations involved with the Accomplishment Plan are listed with their appropriate functions. (See also W79-04138) (Coan-NC)
W79-04137

ACCOMPLISHMENT PLAN, REGION VIII. COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM. APPENDIX,
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 454, Price codes: A03 in paper copy, A01 in microfiche. June 1975. 73 p.

Descriptors: *Water quality control, *Water pollution, *Air pollution, *Regional planning, *Energy impact, *Energy, *Montana, *Colorado, *North Dakota, *South Dakota, *Wyoming, *Utah, *Energy resources, Environmental impacts, Natural resources, Coal oil shale, Project planning, Air pollution abatement, Waste pollution abatement, Ground water, 208 Area-wide planning, Environmental maintenance funding.

This report is an appendix to a foregoing study on the minimization of environmental damage while developing energy resources in Region VIII. It contains charts of the organization structure of the Office of Energy Activities for Region VIII and the 208 planning areas in the Region, including maps of the designated areas. Surface water quality monitoring programs for oil shale and coal resource areas are listed with data on field measurements, chemical, biological and physical parameters, nutrients, metals, organic carbons, and oxygen demand; and maps showing the monitoring programs in the energy resource areas. Maps and tables present locations of, and data on, groundwater and air quality monitoring stations in the Region. A section on contracts summary presents the contract, amount funded, description of the contract, and present status of the contract for FY 1975. The final section describes the energy resources in Region VIII, the amount of these resources, the geographic location of the deposits, probable production of the resources, and the productive capacity of the Region compared to the rest of the nation. (See also W79-04137) (Coan-NC)
W79-04138

SOUTH PLATTE RIVER BASIN ACCOMPLISHMENT PLAN.
Environment Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5G.
W79-04145

PLANNING FOR WATER RESOURCES,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 6D.
W79-04152

THE CANADA WATER ACT ANNUAL REPORT, 1977-1978.
Department of Fisheries and Environment, Ottawa (Ontario).
1978, 36 p.

Descriptors: *Water quality, *Water quality control, *Water law, *Water resources planning, *Water resources management, *Water quality management(Administrative), *Western Canada, *Canada Water Act, Water rights, River basins, Management, Institutions, Water resource research, Public information, Nutrients, Water shortage, Droughts, Canada, Governmental agreements, Data management.

This report covers operations performed under the Canada Water Act up to March 31, 1978. It describes the full provisions under the Act and briefly discusses the individual programs which have been or are expected to be undertaken to meet these provisions. These provisions provide for formal federal-provincial consultative arrangements for water resource matters and for cooperative agreements with the provinces for development and implementation of comprehensive plans for the management of water resources. The programs described include planning studies, implementation agreements, flood damage reduction measures, and other cooperative arrangements. Activities related to the Canada Water Act but not objectives in themselves are also discussed. These include socio-economic studies, water research projects, the study of non-point pollution sources, collection of water data, and development of data management systems. Other provisions of the Act provide for water quality management programs, the regulation of nutrient inputs, and establishment of public information programs. A short section describes the impact of and outlook toward the drought in Western Canada beginning in September 1976 and a longer section describes the principal Federal-Provincial cooperative arrangements under the Canada Water Act. (Coan-NC)
W79-04154

PRECIPITATION MANAGEMENT AND THE ENVIRONMENT, AN OVERVIEW OF THE SKYWATER IX CONFERENCE.
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 2B.
W79-04157

HILL REESTABLISHMENT: RETROSPECTIVE COMMUNITY STUDY OF A RELOCATED NEW ENGLAND TOWN,
New Hampshire Univ., Durham. Water Resources Research Center.
For primary bibliographic entry see Field 6B.
W79-04158

ELECTRIC POWER DEVELOPMENT IN THE PACIFIC NORTHWEST REGION: INSTITUTIONAL COMMITMENTS AND ALTERNATIVES, PHASE 2,
Washington Univ., Seattle. Inst. for Environmental Studies.
K. N. Lee, M. E. Marts, and D. L. Klemka.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 151, Price codes: A08 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University, Pullman, Completion Report, January 1979. 156 p, 3 fig, 1 tab. OWRT A-080-WASH(2), 143-34-10E-3996-3048.

Descriptors: Public policy, *Electric power, Bonneville Power Administration, *Energy policy, Pacific Northwest, Water resource development, *Regional development, *Institutional constraints.

This report extends the work done in an earlier Water Research Center Study of regional electric power planning in the Pacific Northwest (See W77-03288). During 1977 and 1978 a complex set of legislative packages was introduced and debated in Congress and the region. These proposals aimed at comprehensive revision of institutional structure of electric power allocation and planning in the Northwest; the existing structure is based on the Bonneville Project Act of 1937, and has been revised incrementally since then, as described in the earlier report. None of these legislative reformulations was successful, and the 95th Congress adjourned with a commitment to take the question of regional power planning again in 1979. With interregnum prevailing in the region, there is need for evaluating the alternatives proposed, as well as development of new institutional concepts. Discussed are (1) premises for institutional redesign; (2) functions that must be carried at the regional level; (3) prospects for alternative institutional orders emerging from the present political deadlock. In particular, it is argued that the costs and environmental impact on regional energy development will keep power planning enduringly controversial. Accordingly, leadership at the regional level will need to play a larger, more visible role than in the past. Two means by which such leadership might be given the institutional strength needed are (1) reallocation of low-cost federal hydropower on an incentive basis, rather than by either public or residential preference; or (2) encouragement of a regional wholesale power market.
W79-04159

208 WATER QUALITY PLANNING HOW IT WILL AFFECT YOU,
North Carolina State Univ. at Raleigh.
F. J. Humenik.
Irrigation Journal, Vol. 28, No. 3, p 6-7, 17, 24, 25, May-June, 1978.

Descriptors: *Legal aspects, 208 Act, Water pollution control, Water pollution sources, Waste water disposal, Waste water treatment, Water quality control, *Water resources planning act, Planning.

208 is actually a section of Public Law 92-500, the Federal Water Pollution Control Act Amendment of 1972. General goals of this sweeping legislation are to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. A comprehensive discussion of 'Section 208' is presented in this article. (Skogerboe-Colorado State)
W79-04193

NON-POINT POLLUTION AND THE SCS,
Agricultural Engineering, Vol. 59, No. 5, p 19-20, May, 1978.

Descriptors: *Non-point pollution, Water pollution sources, Pollution abatement, Soil conservation, Legal aspects, Return flow.

Agricultural Engineering interviews Glen H. Loomis, PE, director of the Environmental Services Division of USDA-SCS, on the Culver - Amendment to the Clean Water Act. (Skogerboe-Colorado State)
W79-04197

WATER SYSTEMS COUNCIL: A VARIETY OF SERVICES TO PUMP MANUFACTURERS AND THE WATER WELL INDUSTRY,
For primary bibliographic entry see Field 4B.
W79-04240

UPDATE: WHAT'S IN THE WATER.
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 5F.
W79-04242

GEOTHERMAL GOES EAST,
For primary bibliographic entry see Field 3C.
W79-04248

A CASE FOR REAPPRAISAL OF INDIAN WATER POLLUTION STANDARDS AS APPLICABLE TO PULP AND PAPER INDUSTRY,
Central Pulp Mills Ltd., Fort Songad (India).
N. S. Sadawarte, and A. K. Prasad.
Indian Pulp and Paper, Vol. 32, No. 6, p 9, 11-13, 15-17, April/May, 1978. 7 tab.

Descriptors: *Pulp and paper industry, *Water quality standards, *India, Foreign countries, Wastes, Industrial wastes, Water pollution sources,

Biochemical oxygen demand, Pulp wastes, Effluents, Water pollution, Standards, Water policy.

It is concluded that present Indian water pollution standards are too rigid and too general, as well as tougher than those of highly industrialized countries such as Canada and Australia with regard to BOD (kg/ton) discharges from pulp and paper mills. No limits are specified for permissible pollution loads based on type of pulping process, age and location of mills, or nature of receiving streams. Standards are urged that would be sufficiently flexible to judge each mill on its specific circumstances, at the same time, serve to protect the environment without jeopardizing industrial growth. (Brown-IPC)
W79-04255

PROTECTING INSTREAM FLOWS UNDER WESTERN WATER LAW: SELECTED PAPERS.
Cooperative Instream Flow Service Group, Fort Collins, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 993, Price codes: A04 in paper copy, A01 in microfiche. Report No FWS/OBS-77/47, September 1977. Edited by B. L. Lamb. 64 p, 1 append.

Descriptors: *Streams, *Streamflow, *Water quality control, Legal aspects, Water law, Water rights, Western United States, Water Quality Act, Appropriation doctrine, Instream flows.

Five papers suggesting means to protect flows under existing water law and projects development in water law regarding instream flows are presented. These papers were originally presented as a panel at the Western Association of State Game and Fish Commissioners and the Western Division, American Fisheries Society Annual Meeting in Tucson, Arizona, July 13, 1977. The appendix contains a matrix of all strategies for protecting instream flows identified in a recent contract with the Western Energy and Land Use Team of the U.S. Fish and Wildlife Service. (Davison-IPA)
W79-04275

PROGRESS OF PROTECTION OF THE ENVIRONMENT AND RESOURCES IN THE UNITED STATES-A HISTORICAL SURVEY,
Naval Sea Systems Command, Washington, DC.
O. A. Meykar.
IEEE Transactions on Aerospace and Electronic Systems, Vol. AES-10, No. 4, p 521-532, July 4, 1974. 7 ref.

Descriptors: *Legislation, *Environmental control, *Water quality act, *Water pollution control, Federal Water Pollution Control Act, Water law, Rivers and Harbor Act, Clean Air Act, Public health service.

Legislative action on the state and federal levels meant to improve and preserve environmental quality and conserve natural resources, including water resources, was developed and implemented in a logical sequence, synchronized with social development and consciousness of the need for specific legislative, punitive, or constructive actions. The needed legislation was developed through a consensus of opinion, wants, and costs that were to be incurred by those parties affected. At times, the Federal Government was obliged to increase its budget allocations in areas where immediate relief was necessary and large losses expected. (Leibowitz-FIRL)
W79-04278

INSTITUTIONAL ASPECTS OF WATER RESOURCES MANAGEMENT AT SUBSTATE LEVEL,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., D. Rosen, and L. Champney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 307, Price codes: A02 in paper copy, A01 in microfiche. Final Technical Completion Report. January 1979, 20 p, 28 ref. OWRT A-054-NJ(1), 14-34-0001-9032.

Descriptors: *Institutions, *Water supply, Water quality control, *Land use, Governments, Water policy.

This study investigates institutional aspects of water supply/water quality/land use problems in rapidly urbanizing areas, particularly in New Jersey. Recent areawide water quality planning under section 208 of the National Water Pollution Control Act and the start of preparation of a statewide water supply master plan are bringing to light problems which the local, state and regional institutions are not well adapted to handle. Currently available institutions have been evaluated, emerging alternatives have been evaluated, and comparisons have been made of widely different solutions in different areas. Alternative possibilities for improved institutions have been considered.
W79-04309

FEDERAL RESERVED RIGHTS AND THE INTERSTATE ALLOCATION OF WATER,
C. Dirck.
Land and Water Law Review, Vol. 13, No. 3, p 813-833, 1978. OWRT A-027-WYO(3), 14-34-0001-8054.

Descriptors: Reservation doctrine, *Water rights, *Water allocation, Water law, Prior appropriation, Federal reservation, State jurisdiction.

In 1899, the United States Supreme Court allowed the federal government to take water for federal lands without compensating those from whom the water was taken. Today, the problem of allocating the burden of federal reserved rights among the several states of an interstate water basin is an important one. In searching for a solution, interstate compacts must be first examined. Some provide for certain reserved rights to be charged against a particular state's allocation; others do not mention the manner in which federal reserved rights are to be satisfied. Even those that do address the question may have been formed before the nature and extent of the reserved rights were understood, thereby creating other problems. The legal status of reserved rights are reviewed beginning with the original application of the doctrine in 1908 to a river running through an Indian Reservation. In 1963, the Supreme Court extended applications of the doctrine to other federal reservations, such as national parks, forests, and wildlife refuges. In 1976, the Court applied the doctrine to groundwater. Several recommendations are made for alleviating the burden the doctrine places on states. (Stump-Florida)
W79-04346

MARKETING OF SURPLUS WATER FROM FEDERAL RESERVOIRS,
J. M. Dunn.
Land and Water Law Review, Vol. 13, No. 3, p 835-861, 1978. OWRT-A-027-WYO(2), 14-34-0001-8054.

Descriptors: Missouri River, *Water allocation, Political aspects, Industrial water, Prior appropriation, Reservoirs.

In 1944, Congress authorized a plan for the development of the water resources of the Missouri River Basin. At that time the major consumptive use was anticipated to be irrigation, and that is how the water has been used. However, irrigation planned for upper basin states has not been pursued, resulting in unappropriate surplus water available for commitments to future uses. In 1975, the Secretaries of the Army and Interior signed a 'Memorandum of Understanding,' for the purpose of permitting the possible sale of surplus water for industrial purposes. The Secretary of the Interior would determine how much water from the reservoirs that has been allocated to irrigation is in excess of that needed for present and predicted future irrigation needs. The Secretary of the Army would then determine how much of that excess could be made available for industrial uses. No mention is made of state participation in this decision making process. This has generated fear among western states that state policies will be ignored and local benefits sacrificed by federal takeover of this part of the state governmental function. (Stump-Florida)
W79-04347

AMERICAN DREDGING COMPANY V. STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION (ORDER BANNING DUMPING OF DREDGE SOIL IN PROTECTED WETLANDS AREA UPHELD),
For primary bibliographic entry see Field 5G.
W79-04415

NATIONAL FORESTS DO NOT HAVE RESERVED WATER RIGHTS FOR RECREATIONAL PURPOSES,
J. Noble.
Natural Resources Journal, Vol. 18, No. 2, p. 423-26, April, 1978.

Descriptors: *Federal reservations, *National forests, *Reservation doctrine, *Judicial decisions, Public lands, Forests, Federal government, Federal-state water rights conflicts, Water rights, Public benefits, Recreation, Water demand.

The New Mexico Supreme Court applied the reserved rights doctrine to National Forests in Mimbres Valley Irrigation Co. v. Salopek, which arose as a private action to enjoin diversions of water from a stream. The reserved rights doctrine, first put forth in Winters v. United States, was applied to the Gila National Forest in Arizona v. California, when the U.S. Supreme Court stated that the principle of reservation of water rights applied to other federal establishments. Most recently, in Cappaert v. United States, the Court said that federal reservation of appurtenant water extended to that needed to accomplish the purpose of the reservation. This test was used in Mimbres Valley to determine the quantity of water reserved. The purposes of the National Forests include improving and protecting the forest, securing favorable conditions of waterflows, and furnishing a continuous supply of timber. The court found that recreation and minimum instream flow were not purposes for which the Gila National Forest was created. The U.S. Supreme Court granted certiorari, but in the meantime, the Gila National Forest is allowed little water, and the public has effectively been denied recreational use of the area. (Rule-Florida)
W79-04417

WHO OWNS OUR BEACHES,
A. Wolff.
Saturday Review, Vol. 5, No. 21, p. 22-24, July 22, 1978.

Descriptors: *Beaches, *Public access, *California, *Resource allocation, Public rights, Proprietary power, Recreation facilities, Recreation demand, Easements, Coasts, Shores.

Access to beaches is a growing controversy in coastal areas. Longstanding common law and constitutional private property rights are being challenged by public claims to an equitable share in the seashore. The problem is not a physical shortage of shoreline; rather, it is that most beach property is privately owned and off limits to the public. While according to the common law of most states the ocean below the high water line is held in trust by the state for public use, the beach itself may be privately owned and restricted to private use. Rising property values and increasing public need for recreational facilities have combined to create the present conflict. At the same time that open beach advocates are pressing for greater public access to beaches, owners of beach-front property are tenaciously resisting what they perceive as assaults on their property rights. Among the measures which have been instituted to counter open-beach movements are residency-restrictions and access fees to use the beach. This article presents both sides of the beach access controversy, focusing on the current problem in California. (Huck-Florida).
W79-04418

THE LEGAL SIGNIFICANCE OF THE LOCAL GOVERNMENT COMPREHENSIVE PLAN,
T. Arline.
1978, 26 p., Available from Eastern Water Law Center University of Florida, Gainesville, Florida, 32611, $1.75.

Descriptors: *Florida, *Comprehensive planning, Local governments, *Land development, Water resources, Legal aspects, Judicial decisions, Zoning, Water policy, Environmental control, Management, Legislation.

The 1975 Florida Local Government Comprehensive Planning Act (LGCPA) mandates comprehensive land-use planning on the local level. Local governments are required to establish and implement a comprehensive plan for their area of jurisdiction by July, 1979. A local planning agency is to prepare the plan for adoption by the local governing body. Municipalities and counties can develop joint plan. The comprehensive nature of the plan, including nine required and 11 optional elements, is discussed and analyzed in detail. The LGCPA mandates that all development--private and public--and all governmental action that impacts on the land, must be 'consistent' with the plan. Florida courts will be called on to determine what action is 'consistent' with a particular plan. The LGCPA's success will therefore depend in part on the courts' willingness to review local land-use decisions--something they have traditionally avoided doing by applying a 'presumption of validity' test. While the LGCPA is threatened by the courts' abstention from local land-use disputes, it is hoped that this tradition will change as has the tradition of local land-use control. (Easterbrook-Florida)
W79-04420

IDAHO'S ENVIRONMENT (PROBLEM OF UNFETTERED EXPLOITATION RIGHTS V. ENVIRONMENTAL CONCERN),
For primary bibliographic entry see Field 5D.
W79-04421

EPA PROPOSED FAR-REACHING REGULATIONS FOR REDUCING SYNTHETIC ORGANICS IN DRINKING WATER.
For primary bibliographic entry see Field 5F.
W79-04422

ALASKA OIL DISCHARGE PREVENTION AND POLLUTION CONTROL ACT HELD INVALID CHEVRON U.S.A. INC. V. HAMMOND,
J. D. Kimball.
Journal of Maritime Law and Commerce, Vol. 10, No. 2, p 289-92, January, 1979.

Descriptors: *Alaska, *Oil pollution, *Legislation, *Federal jurisdiction, Judicial decisions, Oil spills, Safety, Regulation, Pipelines, Ships, Design standards.

The Trans-Alaska Pipeline opened in 1977. To deal with the potential threat of oil spills in Alaskan waters accompanying the expected heavy volume of tankers, the state enacted the Alaska Oil Discharge Prevention and Pollution Control Act. This Act required that tankers operating in Alaska be equipped with specific safety and maneuvering capability features. The statute also required tankers to carry a 'risk avoidance certificate', issuance of which was contingent upon provision of evidence of financial responsibility to meet liability limits set by the state, and payment of an annual 'risk charge.' However, in Ray v. Atlantic Richfield Company, the U.S. Supreme Court held Washington state's tanker law invalid because it was preempted by the federal Ports and Waterways Safety Act of 1972. The Court stated that Congress intended uniform national safety standards for tankers that would foreclose the imposition of different or more stringent state requirements. An the District Court in Chevron U.S.A., Inc. v. Hammond held that the equipment requirements of the Alaska Act were invalid due to similar pre-emption. The Court also refused to view the risk charges as an insurance program instead of a state regulatory scheme. (Horwich-Florida)
W79-04424

LIABILITY FOR OIL POLLUTION UNDER THE MERCHANT SHIPPING (OIL POLLUTION) ACT 1971,
Aberdeen Univ. (Scotland).
D. J. Cusine.
Journal of Maritime Law and Commerce, Vol. 10, No. 1, p 105-22, October, 1978.

Descriptors: *Oil pollution, *Oil spills, *International commissions, *Damages, Water pollution, Water pollution control, Oil, Common law, International law, Cost repayment, Insurance, Legislation.

At common law, considerable difficulties were experienced in attempts to recover damages for oil pollution caused by discharges from ships. The International Convention on Civil Liability for Oil Pollution Damage (Liability Convention) provides that the owner of a ship shall be liable for any pollution damage caused by oil which has escaped or been discharged from a ship at the time of an incident. The 1971 Merchant Shipping (Oil Pollution) Act provides a code governing civil liability for oil pollution from ships. However, although the Act solves, to a great extent, the problem of the common law, its terms themselves give rise to difficulties. The Act creates liability in respect to discharges from ships carrying oil as cargo, but it does not impose liability for oil discharged from ballast. The Act is not very clear on the question of the responsibility of persons other than owners, especially salvors. The Act appears to attempt to exclude from liability everyone other than the owner, even when the owner does not attract liability. The Act was imprecisely drafted and is almost certain to give rise to considerable litigation. (Fortin-Florida)
W79-04425

COASTAL COMMUNITIES - PARTNERS OR PUPPETS IN OUTER CONTINENTAL SHELF DEVELOPMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy; and Delaware Univ., Newark. Coll. of Marine Studies.
R. Warren.
Coastal Zone Management Journal, Vol. 4, No. 1/2, p 119-25, 1978.

Descriptors: *Continental shelf, *Local governments, *Resources development, *Governmental interrelations, Oil industry, Oil wells, Research priorities, Offshore platforms, Coastal structure, Planning/judicial decisions.

A decision was recently made at the national level to accelerate the development of oil and gas resources on the outer continental shelf. Cities and counties were effectively excluded from this decision-making process. Beyond the fact that research assumed that affected communities would be supportive of development, serious questions have been raised about the utility of studies for state and local administrators and decision-makers. There is an almost complete vacuum with respect to the information available to local officials about the locational intentions of companies that will be involved in exploratory and later stages. Some communities are far from being favorable or even neutral to new energy facilities and are willing to expend time, money and expertise to prevent such development. If there is to be a middle ground between local veto politics and imperial federalism, coastal communities in general, and especially those directly affected, must become recognized participants in public-sector policy making. This can be facilitated by state and federal planning grants, fostering multi-city and county planning efforts, state technical support, and attention by national local governmental and professional organization to provide information about planning and management techniques. (Fortin-Florida)
W79-04426

WHICH WAY TO THE BEACH. PUBLIC ACCESS TO BEACHES FOR RECREATIONAL USE,
M. L. Bryan.
South Carolina Law Review, Vol. 29, No. 4, p 627-65, September, 1978.

Descriptors: *South Carolina, *Public access, *Beaches, *Management, Erosion, Prescriptive rights, Permits, Right-of-way, Coasts, Accretion, Recreation, Comprehensive planning.

By the public trust doctrine expressed in Cape Romain Land and Improvement Co. v. Georgia-Carolina Co. and subsequent case and statutory law, the public's right to use the South Carolina foreshore for recreational purposes is clear. The controls imposed on dry-sand beaches below the vegetation line by the South Carolina Coastal Zone Management Act place that land in trust for the people to protect the land from erosion, resulting in preservation of the beaches for continued recreational use. But historically, conflicts concerning public access to beaches have arisen when rights-of-way to the shore or particular areas of dry-sand beach were enclosed or obstructed so that people could not reach the foreshore where the public's right-to-use were clear. Successful actions to confirm public rights under these circumstances in South Carolina on any theory of prescription, dedication, or custom will require extensive proof of continued use. South Carolina may avoid some of the problems that have produced litigation elsewhere by the comprehensive planning mandated by the State and federal coastal zone management acts. Ways to do this--through use of permitting authority, erosion control authority, and local ordinances--are examined. (Horwich-Florida)
W79-04435

FLOATING NUCLEAR PLANTS - A 'REASONABLE USE' OF THE HIGH SEAS,
M. J. Blake.
California Western International Law Journal, Vol. 8, No. 2, p 191-227, Spring, 1978.

Descriptors: *Nuclear powerplants, *Law of the Sea, *Oceans, *Environmental effects, Marine animals, Marine plants, Pollutants, Reasonable use, Fishing, Radioative wastes, Thermal pollution, Nuclear wastes.

Expanding world energy needs are rapidly depleting the earth's energy bearing natural resources. In response, nations have been seeking and studying alternative energy sources. Nuclear energy is one such source. To avoid environmental, site planning, and cost problems, the idea of placing nuclear power plants on the ocean has gained serious consideration. These plants have been called 'floating nuclear plants' (FNPs). FNP construction, which includes dredging, has the direct environmental effect of destroying biological communities. FNP operation will affect marine life because of the pressure and temperature of the water expelled in the cooling processes. Chemicals and metals are also discharged. The author, in giving a legal analysis of this controversial use of the high seas, discuss the historical international law of the high seas and the provisions of the Third United Nations Conference on the Law of the Sea. Basically, freedom of the high seas has been limited by reasonable use and due consideration for other states. It is essential that the 'reasonableness' test, and the other customary legal concepts discussed, be expanded to meet such environmental dangers as those presented by the FNP concept. (Horwich-Florida)
W79-04436

ROBBINS V. LAKE OSSIPEE VILLAGE, INC. (BEACH USE AND RIGHT-OF-WAY RESEVATIONS IN DEED UPHELD).
389 A. 2d 940-43 (N.H. 1978).

Descriptors: *New Hampshire, *Easements, *Beaches, Access routes, Coasts, Land development, Facilities, Construction, Properties, Right-of-way.

Plaintiff landowner brought this action seeking declaratory and injunctive relief. The plaintiff claimed the defendant corporation could not restrict plaintiff's use of certain beach property owned by the defendant and that he (plaintiff) could not be assessed for his use of the property or beach facilities located on it. When the plaintiff conveyed land to the defendant, plaintiff reserved a 120,000 square foot parcel and a right-of-way to the beach on part of the conveyed property. Defendant planned to subdivide and develop the property. The beach was to be a common area for lot purchasers and the plaintiff. The plaintiff objected. The trial court ruled in favor of the defendant corporation. On appeal, a Court Master reversed. Affirming the Master's pro-plaintiff ruling the New Hampshire Supreme Court ruled that: (1) the plaintiff could place restrictions on the defendant's beach facilities; (2) the deed reserved a right-of-way and a right to use and enjoy the beach in the plaintiff; and (3) the defendant's failure to file restrictions on time resulted in a loss of the right to impose any restrictions on the plaintiff's deed reservations. (Goldberg-Florida)
W79-04437

APPROPRIATION FOR INSTREAM FLOW MAINTENANCE: A PROGRESS REPORT ON 'NEW' PUBLIC WESTERN WATER RIGHTS,
Indiana Univ., Bloomington.
A. D. Tarlock.
Utah Law Review, Vol. 1978, No. 2, p. 211-47, 1978.

Descriptors: *Riparian waters, *Prior appropriation, *Flow system, *Water utilization, Recreation, Wildlife management, Navigable waters, Water conservation, Water law, Water rights, Uniform flow, Stream flow.

In 1975 the dedication of water to instream uses such as fish and wildlife maintenance and recreation was a growing but still minor factor in western water law. The question of whether instream uses would be recognized in the prior appropriation and western riparian system was open. Since 1975, it has become clear that instream uses will be recognized in western water law. The issues are now, how, and to what extent these new uses will be recognized. This article contains an analysis of instream use recognition and protection. Topics discussed are: (1) the philosophy of instream preservation; (2) instream flow preservation standards; (3) elimination of per se barriers to flow preservation appropriations; (4) flow preservation strategies including wild and scenic river programs and federal reserved rights, expanded state definitions of navigable waters, public interest qualifications on appropriations applications, direct state instream use fillings, and water conservation programs. (Goldberg-Florida)
W79-04438

E. I. DUPONT DE NEMOURS & CO. V. TRAIN - EPA AUTHORITY TO SET INDUSTRY WIDE EFFLUENT LIMITATIONS BY REGULATION,
J. F. McNulty, Jr.
Wake Forest Law Review, Vol. 14, No. 3, p 662-77, June, 1978.

Descriptors: *Effluents, *Water pollution control, *Federal water pollution control act, *Judicial decisions, Industrial wastes, Impaired water quality, Inorganic compounds, Industrial water, Water policy, Water treatment standards, Regulation.

The 1972 Federal Water Pollution Control Act Amendments, which completely revised and expanded prior federal water pollution control legislation, are analysed in light of the extreme difficulties experienced with respect to their implementation. Two recent federal court decisions interpreting the 1972 amendments characterized the statutory language as suffering from disquieting ambiguities and containing 'statutory language devoid of plain meaning'. A Supreme Court case--E. I. DuPont de Nemours Co. v. Train--analyzed herein examines the structure of the Act and its ambiguities, focusing on the crucial question of who has the authority under the 1972 Act to set binding effluent discharge regulations for industrial water users. In Dupont, the court gave the federal Environmental Protection Agency power to establish binding national effluent limitations. To accomplish this result the Court engaged in judicial legislation by inferring regulatory powers withheld by Congress in drafting the 1972 Act. The writer concludes that such judicial legislation is undesirable in that it forecloses action in the political arena and retards the development of a true national consensus on difficult issues. (Goldberg-Florida)
W79-04439

CONSERVATION AND THE NEW INFORMAL COMPOSITE NEGOTIATING TEXT OF THE LAW OF THE SEA CONFERENCE,
C. De Klemm.
Environmental Policy and Law, Vol. 4, No. 1, p. 2-17, April 1978.

Descriptors: *Negotiations, *Law of the Sea, *United Nations, *Conferences, Marine animals, Preservation, Ecosystems, Pollution, Exploration, Exploitation, Coasts, Continental shelf.

Negotiations for a new world treaty on the Law of the Sea have been taking place in the United Nation Conference on the Law of the Sea. What is essentially at stake is the extension of sovereign rights over a 200-mile wide Exclusive Economic Zone (EEZ) and over a continental shelf of at least similar width; a monopoly of the coastal states on the resources of those zones; and an important share for developing nations, of the mineral resources of the sea-bed beyond the limits of the coastal-state jurisdiction. The results of the negotiations have been incorporated in a new Informal Composite Negotiating Text (ICNT). This paper is a preliminary analysis of the ICNT, from the point of view of the conservation of marine ecosystems and species. The major gap in the new Law of the Sea draft, from the conservation point of view, is the almost complete absence of any provision relating to the preservation of marine ecosystems. Yet some positive elements also appear; for instance, all aspects of pollution are now taken into consideration in the ICNT. Other provisions of the ICNT are discussed. (Horwich-Florida)
W79-04440

BALANCING THE INTERESTS. THE THIRD UN-LAW OF THE SEA CONFERENCE - (7TH SESSION),
A. R. H. Schneider, L. Kimball, J. C. Bridgeman, and G. Graham.
Environmental Policy and Law, Vol. 4, No. 2, 3, p. 69-77, July, 1978.

Descriptors: *Law of the Sea, *Negotiations, *Treaties, *United Nations, Continental shelf, International waters, Mining, Fishing, Exploration, Exploitation, Pollution, Research facilities.

The third United Nations Law of the Sea Conference (UNCLOS 111), seventh session, decided in April, 1978, on the structure of its negotiations. Conference participants decided to concentrate on seven 'hard-core' issues: Deep sea-bed mining; financial arrangements; organs of the proposed International Sea-Bed Authority; access of land-locked (and other) states to fisheries in the 200-mile exclusive economic zones (EEZ); dispute settlement in regard to coastal states' rights in the EEZ; the continental shelf; and maritime boundaries. Seven special negotiating groups were set up by the participants, and their subject areas defined. Each such group's developments are herein reported. The negotiating time of this session was five weeks. Of the seven negotiating groups set up to deal with key issues, only the one on dispute settlement over fishing rights in the EEZ was able to report that it had fulfilled its mandate. The chairman of most of the others reported progress and suggested tests of treaty articles which they thought might offer a better prospect for consensus; but with the one group as an exception, all groups indicated that further negotiations would be needed at the next treaty session. (Horwich-Florida)
W79-04441

WATER ALLOCATION: CONSTRAINTS AND OPPORTUNITIES,
H. R. Doerksen.
Fisheries, Vol. 2, No. 1, p. 14-16, Jan.-Feb., 1977.

Descriptors: *Water allocation(Policy), *Wildlife management, *Competing uses, *Resources development, Beneficial use, Fish conservation, Fisheries, Resource allocation, Planning, Appropriation, Reservation doctrine, Energy.

In western states, where water resources are scarce, policies relating to water allocation often conflict. One major source of conflict is over the use of water to promote energy development at the expense of fish and wildlife resources. Traditional doctrines of water allocation stress energy development as more important than the preservation of fish and wildlife. Proponents of wildlife management must understand the policies behind western water law doctrines in order to effectively participate in water allocation decisionmaking. Several mechanisms used to allocate water which affect fish and wildlife are examined. These include interstate compacts, construction of federal reservoirs, implied reservation pursuant to specific state and federal programs and private appropriation subject to state laws. Doctrines such as first-in-time first-in-right, beneficial use, necessary diversion and perpetual right are defined and discussed. The need for cooperation between competing interest groups rather than conflict as a means of achieving mutually beneficial and satisfying results is stressed. Rather than viewing the situation in terms of good and bad, a recognition that competing self-interests can be reconciled and result in mutual progress is urged. (Hucks-Florida)
W79-04442

NOTES ON CALIFORNIA'S COASTAL GOVERNANCE: A REPLY TO PETER DOUGLAS,
California Univ., Berkeley. Inst. of Governmental Studies.
For primary bibliographic entry see Field 6A.
W79-04444

CESSATION OF RETURN FLOW AS A MEANS OF COMPLYING WITH POLLUTION CONTROL LAWS,
R. G. Berger.
Public Land and Resources Law Digest, Vol. 15, No. 1, p 52-78, 1978.

Descriptors: *Water pollution control, *Consumptive use, *Waste water disposal, *Beneficial use, Water reuse, Prior appropriation, Municipal wastes, Cost-benefit theory, Evaporation, Reasonable use, Water quality standards, Federal water pollution control act.

With the increasingly stringent effluent limitations of the 1972 Federal Water Pollution Control Act, some municipalities and industrial plants are finding it more economical to cease all water discharge than to restore it to the required quality standard. These total containment, no-discharge pollution control systems substitute evaporation of water from sewage and industrial effluent for treatment and discharge of purified water. All opportunities for subsequent use of the water downstream are thereby terminated. Questions of policy and legality with respect to these systems are examined. Underlying water laws and policies is the goal of obtaining 'maximum social satisfactions' from the water. To achieve this goal, rules of reasonable use and beneficial use have developed. When an established water user in a prior appropriation jurisdiction seeks to implement a total containment system, it must be determined whether this change which increases consumption is a reuse or more efficient use - which is contingent on preserving the rights of others. Other legal, economic, and policy considerations are discussed. (Horwich-Florida)
W79-04445

FEDERAL LANDS AND CONSISTENCY: AN INTERGOVERNMENTAL PLANNING PROPOSAL FOR THE COASTAL ZONE,
For primary bibliographic entry see Field 6A.

W79-04446

TO ESTABLISH A NATIONAL WATER POLICY.
Hearings, Subcommittee on Water Resources, Committee on Environment and Public Works, U.S. Senate, March 31, April 6, 7, 11, 12, 14, 18, 1977, Serial No. 95-H16, 1402 p, app.

Descriptors: *Water demand, *Water management(Applied), Water shortage, *Water policy, Legislation, Water conservation, Surface waters, Water delivery, Future planning(Projected).

These hearings before the U.S. Senate Subcommittee on Water Resources of the Committee on Environment and Public Works attempt to formulate and establish a National Water Policy. At present, there is no well defined National Water Policy. It is a hazy, non-definitive federal effort fragmented among several agencies. The issues addressed herein include: (1) how to prepare for the water needs of a rapidly growing population; (2) provision for emergency, short term situations such as drought; (3) how should responsibility be allocated between federal, state and local bodies; (4) how to strike a balance between the competing needs of industrial and municipal water supply, the environment, hydroelectric power and agriculture for limited supplies of water; and (5) what is being done to find new sources of water for the future. All testimony heard before the committee is included along with maps, graph and tables. (Goldberg-Florida)
W79-04447

THE USE OF CIVIL PENALTIES IN ENFORCING THE CLEAN WATER ACT AMENDMENTS OF 1977,
T. O'Brien.
University of San Francisco Law Review, Vol. 12, No. 3, p 437-63, Spring, 1978.

Descriptors: *Civil law, *Pollution abatement, *Cost analysis, Federal water pollution control act, Regional economics, Environmental control, Judicial decisions, Constitutional law, Damages, Economics.

Society at large now bears the 'social cost' of pollution. Civil penalties are an attempt to meet the challenges of incorporating the externality of pollution into the free market system. The price tag for pollution is now determined by governmental administrators and is ultimately very subjective. Several enforcement methods--legal solutions to the pollution problem--have been tried with varying degrees of success. These include: private damage suits; injunctions; criminal sanctions; and civil penalties. Civil penalties appear to be a very effective tool in enforcing environmental policy, particularly that policy embodied in the 1977 Clean Water Act Amendments. Economically, they are superior to other methods of pollution control because they can accurately incorporate the costs of pollution into the free market system without substantially disrupting it. Legally, civil penalties are flexible and easy to apply; their civil statutes reduces pleading and proof problems and streamlines administrative processes. At the same time, civil penalties neither abridge violators' constitutionally guaranteed protection against self-incrimination nor deny them the due process of law. (Fortin-Florida)
W79-04449

STATE LAW, NOT FEDERAL, DETERMINES RIPARIAN RIGHTS TO ACCRETIONS,
P. J. Ward.
North Dakota Law Review, Vol. 54, No. 3, p 505-14, 1978.

Descriptors: *Riparian land, *Riparian rights, *Accretion, *Judicial decisions, Riparian waters, Avulsion, Erosion, Watercourses(Legal aspects), North Dakota, Common law, Land forming, Water rights.

The law as to riparian owners as it relates to accretion, erosion, and dereliction, as well as avulsion and reliction, is discussed. The development of Supreme Court decisions on these issues is examined and their effect upon state powers is explained. The focus of the discussions is upon the case of Oregon ex rel. State Land Board v. Corvallis Sand & Gravel Co. and the earlier case of Benelli Cattle Co. v. Arizona, which it overruled. The Court ruled in Corvallis that state property law governs riparian ownership, unless some other principle of federal law would require a different result. This reliance upon state law allows for the legislating state to acquire title to increasing portions of land through use of the above theories without later being subject disfeasence. If states take the initiative to change their accretion laws, riparian owners on oceans, lakes, and rivers of this country could, in a matter of time, be separated by state land from the waters which were once the boundaries of their land. (Fortin-Florida)
W79-04450

FLORIDA BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND V. WAKULLA SILVER SPRINGS COMPANY.
362 So. 2d 706-13 (Fla. Ct. App. 1978).

Descriptors: *Florida, *Boundary disputes, *Meanders, *Surveys, Mangrove swamps, Wetlands, Boundaries(Property), Adjacent land owners, High water mark, Legal aspects, Erosion.

A declaratory court action was sought to determine the boundary line separating adjacent tracts of land owned by the plaintiff company and defendant state organization. The tract in question owned by the plaintiff is bounded on three sides by water. It was admitted that the defendant owned adjoining submerged lands. Plaintiff claimed its waterfront lands were conveyed to its predecessors in title by deeds incorporating the plat of the original United States survey of the area. Plaintiff admitted the 'mean high water line' (MHWL) was the actual boundary; however plaintiff claimed the MHWL could not be located accurately because the lands are low, wet mangrove swamp. At a non-jury trial, extensive findings of fact and conclusions of law were made before the court--ruling in favor of the plaintiff--declared the boundary line between the two tracts to be the meander line of the original 1872 United States survey of the area, subject to any subsequent natural changes such as accretion, erosion or reliction. On appeal, the judgement was affirmed in total. (Easterbrook-Florida)
W79-04451

POPE V. CITY OF ATLANTA (ACT REGULATING CONSTRUCTION IN RIVER FLOOD PLAIN HELD NOT TO BE UNCONSTITUTIONAL TAKING OF PROPERTY WITHOUT COMPENSATION).
249 S.E. 2d 16-21 (Ga. 1978).

Descriptors: *Constitutional law, *Surface runoff, *Georgia, *Flood plains, Legislation, Runoff, Rivers, Construction, Water pollution control, City planning, Erosion control, Eminent domain.

Plaintiff property owner brought an action against defendant city, claiming the city's Metropolitan River Protection Act was unconstitutional in that it prohibited plaintiff's construction of a tennis court within the flood plain of the Chatahoochee River. Defendant had issued a stop-work order pursuant to the Act, which required a certificate of compliance for any clearing, construction, excavation, or filling in the stream corridor. After the order was upheld by a federal district court, plaintiff claimed the Act unconstitutionally appropriated private property for public use without compensation. The Georgia Supreme Court held the Act constitutional finding that the inherent police power of the state extends to protection of the public interest, and that unlike eminent domain, the use of the state's police power involves the regulation of property to prevent its use in a manner detrimental to the public interest. Since soil erosion and sediment were major pollution problems in the Chatahoochee, and clearing could increase surface water run-off and erosion, the public interest was served by regulating this activity. Additionally, construction of impervious structures in the flood plain increased runoff, erosion, and the risk of flooding. (Rule-Florida)
W79-04452

UNITED STATES V. STATE OF NEW MEXICO (IMPLIED RESERVATION OF WATER DOCTRINE HELD TO COVER ONLY AMOUNT OF WATER NECESSARY FOR THE PURPOSE OF THE RESERVATION).
98 S. Ct. 3012-26 (1978).

Descriptors: *Federal-state water rights conflicts, *New Mexico, *Reservation doctrine, *National forests, Water rights, Water resources, Surface waters, Water supply, Federal reservations, Water allocation(Policy), Federal government.

The State of New Mexico brought suit to determine its rights, and the rights of the United States, to water of the Rio Mimbres River. The river originates in the upper Gila National Forest, flows southward past more than 50-miles of privately owned lands, and provides substantial irrigation and mining water. The federal government claimed reserved water rights for use in the Gila National Forest. The Supreme Court held that the federal government in setting aside the national forest lands, reserved use of the water only where necessary to preserve timber in the forest or to secure favorable water flows, and did not reserve rights for aesthetic, recreational, wildlife preservation, or stock watering purposes. Although the power to reserve portions of the federal domain for specific federal purposes impliedly authorizes the reservation of appurtenant water, the implied reservation of water doctrine covers only that amount of water necessary to fulfill the purpose of the reservation. Because water in the West is scarce, and more than 50 percent of the available water originates in or flows through national forests, the narrow terms of national forest reservations must be followed. (Rule-Florida)
W79-04453

FEDERAL WATER POLLUTION CONTROL ACT DISCHARGE PERMIT SYSTEM - AN INDUSTRIAL VIEWPOINT,
J. A. Evans.
Natural Resources Lawyer, Vol. 10, No. 4, p 761-67, 1978.

Descriptors: *Federal water pollution control act, *Judicial decisions, *Analysis, *Water quality standards, Permits, Pollution abatement, Standards, Technology, Administrative agencies, Legislation, Water pollution control.

The most important feature of the Federal Water Pollution Control Act (FWPCA) affecting industry is the discharge permitting system--the NPDES permit program. To deal with the important provisions of discharge permits, Sections 301, 304 and 402 of the FWPCA's 1972 Amendments must be considered. Section 301 requires the federal Environmental Protection Agency (EPA) to establish effluent limitations for point discharge sources by July, 1977. Application is required by the 'best practicable technology' available. By July, 1983, effluent limitations must be established which require application of the best available technology economically achievable. Section 304 requires the EPA to establish 'guidelines for effluent limitations' which should 'identify the degree of effluent reduction attainable through the application of best practicable control technology currently available for classes and categories of point sources'. Section 402 requires a NPDES permit for any discharge. Although the EPA has read Sections 301 and 304 in connection with each other and concluded that one set of regulations can satisfy each section, industry has disagreed with EPA's conclusion. These sections and the issues surrounding them have been the subject of much litigation. Prominent cases are discussed and analyzed. (Easterbrook-Florida)
W79-04454

BUREAU OF RECLAMATION REQUIRED TO COMPLY WITH CALIFORNIA WATER ALLOCATION PROCEDURES,
R. L. Puglisi.
Natural Resources Journal, Vol. 18, No. 2, p 727-30, April, 1978.

Descriptors: *Federal reclamation law, *Reclamation, *Appropriation, *Judicial decisions, California, Unappropriated water, Water rights, Projects, Water law, Federal-state water rights conflicts, Water utilization.

The Supreme Court has recently agreed to review the case United States v. California. Federal district and appeal courts ruled in the case that the federal Bureau of Reclamation need not comply with state water laws in obtaining water to be used for federal reclamation projects but will be legally required to file in accordance with state laws in order to determine the availability of water and to give adequate notice of the project. This decision was supported by Hancock v. Train, which basically held that federal installations are subject to state regulations only where Congressional intent to do so is clear and unambiguous. Congressional intent to require federal reclamation projects to submit to state control regarding water permits and conditions subsequent was not clear and unambiguous in the 1902 federal Reclamation Act. The impact of U.S. v. California--a case of first impression--is not wholly clear. The decision was significant in terms of rejecting state conditions on new permits for unappropriated water in federal reclamation projects. Yet presently, most of the water in the West is already appropriated; therefore, the practical consequences of the decision could be miniscule. (Easterbrook-Florida)
W79-04455

HUELSMANN V. STATE (RECOVERY DENIED FOR LOSS OF WELL WATER CAUSED BY HIGHWAY CONSTRUCTION).
For primary bibliographic entry see Field 2F.
W79-04456

FEDERAL WATER POLLUTION CONTROL ACT AMENDMENTS OF 1977 (SEATTLE, WASH.).
Hearing, Subcomm. on Environmental Pollution, Committee on Environment and Public Works, U.S. Senate, June 6, 1977, Serial No. 95-H25, Part 3, 399 p.

Descriptors: *Water treatment, *Federal water pollution control act, *Evaluation, *Water quality, Financing, Water pollution treatment, Cost allocation, Water quality standards, Regulation, Permits, Pollution abatement.

This hearing before the U.S. Senate Subcommittee on Environmental Pollution took testimony from the public on what amendments, if any, should be made to the Federal Water Pollution Control Act (FWPCA). The hearing focused on two issues: municipal and industrial compliance with the FWPCA. Also examined were alternatives to the national uniform secondary treatment standard for municipalities and the related question of how federal financing might relate to that flexibility. The questions addressed were: (1) Should the law provide flexibility in the secondary treatment standard for those communities who can develop a more efficient and economical alternative; (2) How are the comparative benefits of such an alternative to be determined; (3) How should the federal government fund such alternatives; (4) How are federal funds allocated; and (5) Should states be required to assist smaller communities in these endeavors. Other issues examined were: (1) the extent to which current programs will achieve the basic goal of the federal Clean Water Act; and (2) the effects of compliance with the FWPCA's 1977 best-practicable-treatment technology requirement, and 1983 best-available treatment technology requirements. All testimony heard before the Subcommittee is included, along with maps, graphs and charts. (Goldberg-Florida)
W79-04457

DEVELOPMENT OF THE HARD MINERAL RESOURCES OF THE DEEP SEABED.
Hearings, Subcomm. on Mines and Mining, Committee on Interior and Insular Affairs, U.S. House of Reps., March 29, April 4 and 5, and May 12, 1977, Serial No. 95-7, 642 p.

Descriptors: *Mining, *Oceans, *Negotiations, *Law of the sea, Mineral industry, International law, International waters, Conferences, United Nations, Ownership of beds, Treaties.

These hearings before the U.S. House of Representatives' Subcommittee on Mines and Mining were held to discuss House Bills 3350 and 3652--two bills dealing with the development of the hard mineral resources of the deep seabed. Bill 3350 is a bill to promote the orderly development of hard mineral resources in the deep seabed, pending the adoption of an international regime relating thereto. Bill 3652 is a bill to insure the development of United States ocean mining capabilities and to support the continuation of the United Nations' Law of the Sea Conference negotiations. All testimony heard before the committee in included along with maps, graphs and tables. Development of the mineral resources of the sea which lie beyond the boundaries of any nation has been the subject of extensive international discussion and negotiations. Most of the negotiating has occurred at the Law of the Sea Conferences. Testimony expressing the position of the nation's private industrial sectors, was given. All testimony given before the Subcommittee is included verbatim, along with maps, graphs and tables. (Goldberg-Florida)
W79-04458

WATER SYSTEMS AND THEIR EMERGENCIES,
California Univ., Irvine. School of Engineering.
For primary bibliographic entry see Field 6B.
W79-04497

6F. Nonstructural Alternatives

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME II, APPENDIX A: ECONOMIC DATA AND ANALYSIS.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6C.
W79-04140

COASTAL COMMUNITIES - PARTNERS OR PUPPETS IN OUTER CONTINENTAL SHELF DEVELOPMENT,
Delaware Univ., Newark. Coll. of Urban Affairs and Public Policy; and Delaware Univ., Newark. Coll. of Marine Studies.
For primary bibliographic entry see Field 6E.
W79-04426

6G. Ecologic Impact Of Water Development

MOVEMENTS OF LARGEMOUTH BASS (MICROPTERUS SALMOIDES) IN IMPOUNDED WATERS AS DETERMINED BY UNDERWATER TELEMETRY,
Mississippi State Univ., Mississippi State.
For primary bibliographic entry see Field 2H.
W79-04016

DREDGED MATERIAL RESEARCH PROGRAM, FOURTH ANNUAL REPORT.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 409, Price codes: A07 in paper copy, A01 in microfiche. Report, January 1977. 165 p.

Descriptors: *Environmental effects, *Dredging, *Research priorities, Environmental engineering, Environment, Research facilities, Water, On-site investigations, Wetlands, Marsh management, Projects, Disposal, Effects, Water quality, Habitats, Marsh development.

The objectives of the Dredged Material Research Program are to provide, through research, definitive information on the environmental impact of dredging and dredged material disposal operations and to develop technically satisfactory, environmentally compatible, and economically feasible dredging and disposal alternatives, including consideration of dredged material as a manageable resource. Specific goals are to establish definitively the effects of open-water, land, and wetland disposal on water quality and organisms; to test and evaluate concepts of marsh development and land and water habitat development as environmentally beneficial disposal alternatives; to improve and enhance the acceptance of confined land disposal as an alternative and to consider regulation of the dredging/disposal operation as an environmental control measure; and to develop and test concepts for using disposal sites for productive purposes and to consider the use of dredged material as a natural resource. Presented in the report was detailed information on the status of the DMRP up to January 1, 1977. Highlights of 1976 were accented, objectives of the field studies were emphasized and illustrated, and attention was given to results achieved or anticipated. (See also W78-04534) (Froehlich-ISWS)
W79-04044

PLANNING FOR PROPER USE OF LAND AND WATER.
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 6A.
W79-04113

ACCOMPLISHMENT PLAN, REGION VIII. COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 6E.
W79-04137

ACCOMPLISHMENT PLAN. REGION VIII. COMPREHENSIVE ENERGY-ENVIRONMENT PROGRAM. APPENDIX,
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 6E.
W79-04138

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME I: MAIN REPORT.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 4D.
W79-04139

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME II, APPENDIX A: ECONOMIC DATA AND ANALYSIS.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6C.
W79-04140

INTERIM REPORT, SOUTH UMPQUA RIVER. VOLUME IV, APPENDICES E THROUGH J, REPORTS OF COORDINATING AGENCIES.
Army Engineer District, Portland, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 963, Price codes: A12 in paper copy, A01 in microfiche. Review Report on Umpqua River and Tributaries, OR, December 1971. 260 p, one of 5 volumes.

Descriptors: *Water resources development, *Multiple-purpose reservoirs, *Umpqua River(OR), *South Umpqua River(OR), *Environmental impacts, Oregon, Archeology, Water quality, Turbidity, Forest management, Fish management, Wildlife management, Irrigation, Land management, Environmental effects, Dam construction, Days Creek(OR), Fish and Wildlife Service, Environ-

mental Protection Agency, Bureau of Reclamation, Bureau of Land Management, Forest service, National Park Service, Reservoirs, Recreation.

These appendices are detailed reports by the cooperating agencies participating in the study. Appendix E, by the Fish and Wildlife Service, details the significant effects that the proposed Days Creek dam and reservoir project would have on fish and wildlife resources. It was suggested that fish and wildlife conservation and development be included as a project purpose. Appendix F, by EPA, reviewed the report with respect to a change in site for the South Umpqua dam and reservoir from the Tiller Reservoir site to the Days Creek site; any major changes in the economic and demographic projections used for the earlier siting; current water quality standards; and policy changes in evaluating project-associated benefits. Recommendations are that turbidity potential be studied further; multi-level reservoir outlets be provided for fishery purposes; and water quality monitoring facilities be provided. Appendix G consists of correspondence from the Bureau of Reclamation to the Corps detailing estimates of irrigation water requirements and storage benefit data for use in formulation studies for the Umpqua River Basin Report. Appendix H, by the Bureau of Land Management, presents the impacts that construction of the Days Creek project would have on resources, programs, and lands administered by the Bureau. Appendix I, by the Forest Service, studies the project impact on management of Forest Service lands and the overall effects of the project on the environment, resources, and local economy. The Forest Service finds that the project would be compatible with its duties. Appendix J, by the National Park Service, details the results of a survey of the archeological potential of the proposed sites, concluding that the Days Creek site has fewer archeological materials than its alternative. (Zayac-NC)
W79-04141

INTERIM REPORT, SOUTH UMPQUA RIVER. TRANSCRIPT OF PUBLIC MEETINGS.
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6B.
W79-04142

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI. VOL. 1, MAIN REPORT.
White River Basin Coordinating Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 948, Price codes: A11 in paper copy, A01 in microfiche. June 1968, 188 p, 18 fig, 40 tab, 2 plates, 12 attachments.

Descriptors: *White River Basin(AR and MO), *River basin development, *Agricultural watersheds, *Forest watersheds, *Watersheds, *Planning, *Water resources planning, Regions, Water resources development, Water supply, Water allocation(Policy), River flow, Flow augmentation, Floods, Water quality, Outdoor recreation, Fish and wildlife, Recreation demand, Flood control, Flood prevention, Economic evaluation, Plan implementation.

This study was undertaken to determine the short- and long-term water and related land resource needs of the White River Basin, an agricultural-rural area lying in northeastern and eastern Arkansas and southern Missouri, in order to formulate a comprehensive development plan and recommend which projects and programs should be initiated in the first 10-15 years. Analysis of the Basin included factors of economic development, current status of resource planning, water resource problems and needs, plan formulation process, a proposed plan of development, cost considerations, the nature of local cooperation in the planning process, and implementation procedures. Projects and programs considered included reservoir sites for flood control, recreation and hydroelectric power, levees for flood protection and other flood protection measures, and channel improvements. The plan must be flexible and should be used as a guide for the development and beneficial use of the water and related land resources of the basin, with each appropriate public agency using the plan to augment its own water planning program. Findings indicate that flood losses in the Basin might be considerable. Water supplies as a whole are adequate, but some areas will suffer water shortages during low flow periods, unless proper facilities are planned and constructed; municipal and industrial water use is projected to increase 6-fold between 1980 and 2020. Pollution is not currently a problem. Hydroelectric power production will increase 7-fold between 1980 and 2020. Outdoor recreation demand will increase rapidly and should be provided for in the proposed plan. It was concluded that the proposed plan would meet the projected needs of the Basin to the year 2020. (Arnold-NC)
W79-04146

COMPREHENSIVE BASIN STUDY: WHITE RIVER BASIN - ARKANSAS AND MISSOURI. VOL. VI: APPENDIX P - PLAN FORMULATION.
White River Basin Coordinating Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A043 949, Price codes: A18 in paper copy, A01 in microfiche. June 1968, 187 p, 58 tab, 46 plates.

Descriptors: *White River Basin(AR and MO), *River basin development, *Agricultural watersheds, *Forest watersheds, *Watershed management, *Water resources development, *Planning, *Water resources planning, Regions, Water supply, Water allocation(Policy), River flow, Flow augmentation, Floods, Water quality, Water quality control, Irrigation, Outdoor recreation, Fish and wildlife, Flood control, Flood prevention, Economic evaluation, Plan implementation, Hydroelectric power, Navigation.

This study was undertaken to determine the short- and long-term water and related land resource needs of the White River Basin in Arkansas and Missouri. This Appendix details the process of plan formulation for the Basin outlined in Vol. 1: Main Report. The following water resource problems and needs are further delineated: watershed protection, flood control and prevention, drainage, outdoor recreation, fish and wildlife, hydroelectric power, navigation, water supply, water quality control, and irrigation. Planning considerations of control improvements, watershed protection, levee and channel improvement projects, and conservation measures were evaluated in light of their contribution to the overall plan; all four considerations were found not to be entirely independent of each other. Cost-benefit analyses were included where data were available. The Appendix cites the need for planned flood control projects; channelization projects; conservation programs to reduce erosion, surface runoff, and peak flows in the watersheds; and the need for further irrigation projects in the Basin. A detailed discussion is presented of the proposed plan for each of the water resource problems and needs identified in the Basin, including the development of the plan, with programs and projects considered and recommended for implementation in the short-range (10-15 year) plan and the long-range plan; Department of Agriculture plans are discussed as these relate to the plan; and the effects of the 10-15 year plan are presented, along with an economic evaluation of projects in the 10-15 year plan. (Arnold-NC)
W79-04147

MACOMB COUNTY AREA OF PARTICULAR CONCERN INVENTORY.
Southeast Michigan Council of Governments, Detroit.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 392, Price codes: A04 in paper copy, A01 in microfiche. August 1976, NOAA Office of Coastal Zone Management, Washington, D.C., 55 p, 13 ref, 2 append.

Descriptors: *Coasts, *Shores, *Water resources, *Conservation, *Michigan, *Coastal zone management, *Macomb County(MI), *Areas of particular concern, Coastal plains, Resources development, Wetlands, Cities, Urbanization, Floods, Ecology, Land use, Dunes, Erosion, Coastal resources, Lake St Clair(MI), Resource inventory, Residential development.

The purpose of this inventory is to identify critical areas of Macomb County's coastal zone. The critical zone is defined as the U.S. portion of Lake St. Clair, all lands lakeward of the first principal arterial landward of the lake, and those areas further inland tentatively designated by the Federal Insurance Administration as being within the 100-year Great Lakes flood plain. Macomb County encompasses an area of about 481 square miles; Lake St. Clair defines the eastern and southern boundaries of the county, with approximately 29 miles of shoreline. This report discusses the preliminary results of the Macomb County Area of Particular Concern Inventory. The discussion includes a description of the issues and conflicts associated with each category of area of particular concern, in addition to a description of each area nominated. The areas consist of flood hazard areas; wetlands; recreation areas; river mouths and bays; and urban areas. The criteria used in preliminary nomination of areas of particular concern were those set forth by the Michigan Department of Natural Resources. The set of criteria, in addition to data sheets on the areas, are presented in appendices. (Coan-NC)
W79-04148

IRRIGATION MANAGEMENT SERVICE AND MOSQUITO CONTROL,
Colorado State Univ., Fort Collins. Center for Disease Control.
For primary bibliographic entry see Field 3F.
W79-04175

A RECORD OF PALAEODIPTERON WALKERI IDE (DIPTERA: NYMPHOMYIIDAE) FROM MAINE: A SPECIES AND FAMILY NEW TO THE UNITED STATES,
Maine Univ. at Orono. Dept. of Entomology.
T. M. Mingo, and K. E. Gibbs.
Entomology News, Vol. 87, No. 5 and 6, p 184-185, May and June 1976. 3 ref. OWRT A-028-ME(1).

Descriptors: *Entomology, *Insects, *Palaeodipteron walkeri Ide, *Narroguagus River(Maine), Aquatic habitats, Surveys, River flow, Running waters, Currents(Water).

A pair of adult Palaeodipteron walkeri Ide in coupla were collected during the course of a general aquatic survey on the Narraguagus River, Hancock County, Maine, on August 8, 1974. Although the species has been reported in eastern Canada, this represents a first reporting of the species in the U.S. This species belongs to a small family of rare, minute flies which is aquatic in the larval stage and is associated with aquatic mosses; it is both aquatic and aerial in the adult stage. (Davison-IPA)
W79-04265

AQUATIC ENVIRONMENTAL ANALYSIS IN THE LOWER YELLOW-STONE RIVER,
Montana Fish and Game Dept., Helena. Ecological Services Div.
P. J. Graham, and R. F. Penkal.
July 1978. 112 p, 54 fig, 9 tab, 39 ref, 4 append. 6-07-01-10810.

Descriptors: *Aquatic environment, *Fish behavior, *Yellowstone River(Montana), Sauger, Dams, Diversion structure, Turbidity, Migration, Spawning, Hydrologic data, Depth, Water surface profile program, Streamflow.

A study of the potential effects of streamflow alterations on sauger and walleye in the lower Yellowstone River is reported. Movements of these fish were correlated to spawning, feeding, over-wintering and other biological activities, and effects of low dams on their movements were assessed. The walleye moved upstream from the Garrison reservoir to the lowest located diversion,

spawned and returned to the reservoir during spring. There was extensive sauger movement over the lower diversion in the spring, and general upstream movement of mature sauger after spawning. Some sauger and no walleye migrated over the upper diversion where a 0.5 m vertical drop in the river was created. Initial combined spawning criteria for sauger and walleye were determined, and a method for collecting water surface profile data in a large, deep, turbid river was developed. The limitations and potential improvements of data collection and analysis are discussed. (Davison-IPA)
W79-04276

DISINTEGRATION OF A TRADITIONAL RESOURCE-USE COMPLEX: THE OTOMI OF THE MEZQUITAL VALLEY, HIDALGO, MEXICO,
Clark Univ., Worcester, MA.
K. Johnson.
Economic Geography, Vol. 53, No. 4, p 364-367, Oct. 1977. 1 fig, 4 ref.

Descriptors: *Social impact, *Rural sociology, *Economic impact, *Irrigation practices, *Economic feasibility, Water shortage, Terracing, Water harvesting, Salinity, Waterlogging, Arid lands, Agricultural engineering, Crop production, Surface waters, History, Distribution patterns, Mexico.

Since prehistoric times, desert dwellers in the rainshadow of the eastern Sierra Madres have had to devise strategies to enable them to take full advantage of scarce and erratic precipitation. To facilitate the practice of agriculture, these people have constructed walls in gullies and up hillsides in a terrace-like fashion to trap water and soil. Careful construction along with the planting of Maguey (agave sp.) on the field borders for reinforcement, has made it possible for them to live and prosper in this region for centuries. Today, however, the problems threatening the survival of these people are no longer physical but social and economic. The resource base supporting these people has slowly deteriorated as the children have begun to go to school, men seek alternative employment outside the area, and women no longer weave fiber cloth. The expansion of irrigation networks into this area has been a mixed blessing as increasing water supplies have in some communities brought severe salinization and waterlogging. As desertification continues to take a destructive hold upon this region its apparent causes are not predominately physical but rather the social and economic deterioration of indigenous technologies. (Tickes-Arizona)
W79-04293

WATER CONTROL AND DESERTIFICATION, THE RESETTLED NOMADS OF DEH LURAN, IRAN,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 6A.
W79-04306

THE LEGAL SIGNIFICANCE OF THE LOCAL GOVERNMENT COMPREHENSIVE PLAN,
For primary bibliographic entry see Field 6E.
W79-04420

WATER ALLOCATION: CONSTRAINTS AND OPPORTUNITIES,
For primary bibliographic entry see Field 6E.
W79-04442

7. RESOURCES DATA

7A. Network Design

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME 2: APPENDIX.
Camp, Dresser, and McKee, Boston, MA.
For primary bibliographic entry see Field 5D.
W79-04136

DATA NEEDS IN URBAN HYDROLOGY,
Geological Survey, Portland, OR. Water Resources Div.
D. J. Lystrom.
In: Proceedings of Engineering Foundation Conference on Water Problems of Urbanizing Areas, New England College, Henniker, New Hampshire, July 16-21, 1978. 9 p, 2 fig, 3 tab.

Descriptors: *Urban hydrology, *Urban runoff, *Water quality, *Data collections, *Standards, United States, Planning, Model studies, Hydrologic data, Rainfall-runoff relationships, Data storage and retrieval.

A national urban studies program is being formulated by the U.S. Geological Survey in a cooperative effort with the U.S. Environmental Protection Agency. The data collection aspect of this program is intended for testing and calibration of urban storm-water models. The results of the modeling phase will be used to direct the data collection phase. The objectives for collection of rainfall runoff and quality data are to define urban stormwater problems, to test alternative management techniques and to enhance understanding of the water quantity/quality processes. Proposed guidelines for standardizing data collection on a national basis are presented. (Woodard-USGS)
W79-04409

7B. Data Acquisition

VEGETATIVE COMMUNITIES OF THE GREAT DISMAL SWAMP: IDENTIFICATION AND MAPPING WITH SEASONAL COLOR INFRARED PHOTOGRAPHS,
Geological Survey, Suffolk, VA. Water Resources Div.
P. Gammon.
In: Aerial Color Photography in the Plant Sciences and Related Fields; Proceedings of the Sixth Biennial Workshop, Colorado State University, Fort Collins, p 111-131, August 9-11, 1977. 1 fig, 5 tab, 15 ref.

Descriptors: *Remote sensing, *Vegetation, *Swamps, *Aerial photography, *Mapping, Classification, Wetlands, Coastal plains, Virginia, North Carolina, National wildlife refuges, *Great Dismal Swamp.

The Great Dismal Swamp of Virginia-North Carolina is a forested wetland which has been extensively altered by fire, timbering and ditching. Seasonal high- and low-altitude color infrared photographs have been used to identify and map specific swamp vegetative communities. A vegetation map was prepared at a scale of 1:100,000 using a U.S. Geological Survey 7.5-minute orthophotomosaic as the base map. Vegetative cover classes for the Great Dismal Swamp were defined to provide maximum habitat information for management of the swamp by the U.S. Fish and Wildlife Service. These classes are based on dominant canopy species and type and extent of understory. Using these classes in combination resulted in 43 separate canopy designations and 243 specific vegetative communities. Evaluation of class accuracy was accomplished by helicopter overflight using sample sites selected by two methods. A canopy or understory map unit was considered correct if at least one of the classes was identified in the field sample. Using this criterion, canopy accuracy was 93.8% and understory accuracy was 90.5%. (Woodard-USGS)
W79-04018

REMOTE SENSING OF SUBMARINE SPRINGS: FLORIDAN PLATEAU AND JAMAICA, WEST INDIES,
Geological Survey, Woods Hole, MA. Water Resources Div.; National Park Service, San Francisco, CA.; and Geological Survey, Miami, FL. Water Resources Div.
F. A. Kohout, M. C. Kolipinski, and A. L. Higer.
In: Proceedings of the 2nd International Symposium on Ground Water, Palermo, Italy, April 28-May 2, 1973: International Association for Hydraulic Research, p 571-578, 1973. 9 fig, 12 ref.

Descriptors: *Remote sensing, *Submarine springs, *Discharge(Water), *Oceans, *Aerial photography, Coasts, Atlantic Ocean, Thermal water, Water types, Flow, Florida, *Infrared imagery, *Caribbean, *West Indies, Floridan Plateau, Jamaica, Turbidity plumes, Coastal waters.

A change in the turbidity plume formed by a submarine spring located 2.5 miles offshore from Crescent Beach on the northeast coast of Florida suggests that flow from the spring may be decreasing in intensity with time. This decrease may correlate with increased pumpage in the artesian Floridan aquifer which underlies the mainland. In a cooperative project with the United Nations Development Program and the Jamaica Geological Survey Department, the National Aeronautics and Space Administration took more than 17,000 frames of color and infrared color photography of Jamaica and its coastal waters in April 1971. Submarine springs on the north-central coast of Jamaica discharge primarily clear water from karstic limestone and were not discernible in the aerial photos. In contrast, submarine springs on the south coast discharge from sand and gravel aquifers and turbidity plumes are clearly visible in photographs. A significant anomaly was discovered in infrared imagery of the northeast coast of the island after the field investigation was completed. The anomaly is presumed to be evidence of submarine ground-water discharge. (Woodard-USGS)
W79-04020

HISTORICAL PROFILE OF QUALITY OF WATER LABORATORIES AND ACTIVITIES, 1879--1973,
Geological Survey, Reston, VA. Water Resources Div.
W. H. Durum.
Geological Survey open-file report 78-432, 1978. 235 p, 4 fig, 3 tab.

Descriptors: *History, *Water quality, *Laboratories, *United States, Federal government, Laboratory equipment, Chemical analysis, Analytical techniques, Surface waters, Groundwater, Sediment transport, Programs, Budgeting, Costs, Data processing, Publications, *US Geological Survey, *Water Resources Division laboratories, Laboratory locations.

During the period 1918 to 1973 the U.S. Geological Survey, Water Resources Division, established 22 District-type water quality laboratories. These facilities provided the analytical capability and water-quality information for hydrologic investigations and the national baseline inventory of chemical, physical, fluvial sediment, and biological characteristics of surface and ground waters in the United States. Prior to 1950, most methods used in the laboratory were gravimetric, colorimetric, or titrimetric. Flame photometric equipment was common to most laboratories in the 1950's, and the atomic absorption spectrophotometer was added to larger laboratories in the 1960's. In the late 1960's, the first of the automatic analyzers was installed. Total annual production averaged about 480 adjusted complete analyses during the early years 1919-28, about 7,800 in 1946, and about 50,000 in 1970. Budget estimates for the majority of laboratories ranged from $25,000 to $50,000 (1940-50) and $75,000 to $300,000 (1965-73). Beginning in 1972, major functions of the 22 laboratories have been combined into two comprehensive highly-automated facilities located at Denver (Arvada), Colo., and Atlanta (Doraville), Ga. These laboratories comprise the Central Laboratory System for the U.S. Geological Survey. (Woodard-USGS)
W79-04034

USING SATELLITE IMAGERY TO DETECT AND ESTIMATE RAINFALL FROM FLASH-FLOOD PRODUCING THUNDERSTORMS,
National Environmental Satellite Service, Washington, DC. Applications Div.

For primary bibliographic entry see Field 2B.
W79-04072

HYDROLOGIC PARAMETERS FROM LANDSAT IMAGERY FOR WILLIAMS FORK WATERSHED,
Colorado State Univ., Fort Collins. Civil Engr. Dept.
For primary bibliographic entry see Field 5A.
W79-04073

APPLICATION OF A VERSION OF THE STANFORD MODEL TO A SMALL PIEDMONT WATERSHED,
Clemson Univ., SC. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W79-04086

HYDRAULIC AND ELECTRO-OSMOTIC PERMEABILITY COEFFICIENTS,
Wisconsin Univ. Milwaukee. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W79-04092

UPPER TRINITY RIVER BASIN COMPREHENSIVE SEWERAGE PLAN, VOLUME 2: APPENDIX.
Camp, Dresser, and McKee, Boston, MA.
For primary bibliographic entry see Field 5D.
W79-04136

TENSIOMETERS TEACH HOW TO SAVE FUEL AND WATER,
For primary bibliographic entry see Field 3F.
W79-04165

NEW FLUME BREAKTHROUGH FOR DITCH IRRIGATORS,
Science and Education Administration, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3F.
W79-04169

GREENHOUSE EVALUATION OF RESIDUAL PHOSPHATE BY FOUR PHOSPHORUS METHODS IN NEUTRAL AND CALCAREOUS SOILS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04178

DEVELOPMENT OF A DTPA SOIL TEST FOR ZINC, IRON, MANGANESE, AND COPPER,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 2K.
W79-04179

AN ACOUSTIC PROBE FOR PRECISE DETERMINATION OF DEEP WATER LEVELS IN BOREHOLES,
South Australia Dept. of Agriculture and Fisheries, Adelaide.
G. Schrale, and J. F. Brandwyk.
Ground Water, Vol 17, No 1, p 110-111, January-February 1979. 2 fig, 3 ref.

Descriptors: *Water levels, *Measurement, *Instrumentation, On-site data collections.

An acoustic probe for quick and precise measurement of deep water levels in boreholes is described. The device is lowered with a surveyor's tape and emits a sound when it touches the water surface. The probe consists of a brass cylindrical housing and a carriage accommodating the electronic ports. The materials for the probe cost less than $15.00 (Australian) and it can be assembled in less than 4 hours. (Purdin-NWWA)
W79-04241

CHANNEL EROSION SURVEYS ALONG THE TAPS ROUTE, ALASKA 1977,
Geological Survey, Anchorage, AK. Water Resources Div.
For primary bibliographic entry see Field 2J.
W79-04411

WATER SAMPLING BUCKET,
T. Zubricki.
U.S. Patent No. 4,122,721, 4 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 975, No. 5, p 1760, October 31, 1978.

Descriptors: *Patents, *Sampling, *Water sampling, Temperature, Salinity, Instrumentation, Thermometers.

A water sampling bucket for use in determining water surface temperature and salinity in the ocean has a thermometer supported at one end within a rubber grommet. The mercury bulb end is submerged in a water sampling portion which is clear plastic where the temperature markings occur. The sampler contains an opening at its bottom end for receiving sampled water, and encompasses the lower end of the thermometer which is coated with a heavy impact resistant material. The object of the invention is to provide a readily submersible water sampling bucket which does not change temperature for extended periods of time, once in the air and/or exposed to direct sun. (Sinha-OEIS)
W79-04459

7C. Evaluation, Processing and Publication

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04009

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1977--VOLUME 2. UPPER MISSISSIPPI AND MISSOURI RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Geological Survey Water-Data Report MN-77-2, September 1978. 426 p, 3 fig.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Upper Mississippi River basin, *Missouri River basin.

Water resources data for the 1977 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Upper Mississippi and Missouri River basins and contains discharge records for 66 gaging stations; stage and contents for 9 lakes and reservoirs; water quality for 36 gaging stations, 5 partial-record flow stations, 27 lakes, and 15 wells; and water levels for 93 observation wells. Also included are 102 crest-stage partial-record stations and 64 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS)
W79-04023

LIMNOLOGICAL CHARACTERISTICS OF CYPRESS LAKE, UPPER KISSIMMEE RIVER BASIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 2H.
W79-04025

HYDROLOGIC DATA FOR SOLDIER CREEK BASIN, KANSAS,
Geological Survey, Lawrence, KS. Water Resources Div.
W. J. Carswell, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-288 740, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 78-87, July 1978. 26 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Hydrologic data, *Computer programs, *Data collections, *Methodology, *Watersheds(Basins), Rainfall, Streamflow, Sediment transport, Observation wells, Water levels, Water quality, Kansas, *Soldier Creek basin, *Magnetic tape.

Selected hydrologic data collected in the Soldier Creek basin in northeastern Kansas are available on magnetic tape in card-image format. Data on the tape include water discharge in fifteen-minute and daily time intervals; rainfall in fifteen-minute and daily time intervals; concentrations and particle sizes of suspended sediment; particle sizes of bed material; ground-water levels; and chemical quality of water in concentrations of selected constituents. The data-collection system includes: (1) 7 recording streamflow stations; (2) 5 recording rainfall stations; (3) 51 nonrecording rainfall stations located within and adjacent to the basin; (4) 31 ground-water observation wells (two recording); and (5) intermittent chemical quality of water and sediment sampling sites. Examples of the information on magnetic tape for each type of data collected are presented in computer-printout format. (Woodard-USGS)
W79-04026

WATER IN THE SKAGIT RIVER BASIN, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
B. W. Drost, and R. E. Lombard.
Washington Department of Ecology Water-Supply Bulletin 47, 1978. 247 p, 20 fig, 2 plates, 11 tab, 43 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Precipitation(Atmospheric), *Melt water, Water supply, Glaciers, Available water, Water demand, Water utilization, Water quality, Land use, Water temperature, Floods, Low flow, Hydrologic budget, *Washington, *Skagit River basin, North Cascades.

The 2,730-square-mile Skagit River basin in Washington is largely mountainous and contains 396 glaciers that cover nearly 65 square miles, the largest volume of snow and ice storage in a single basin within the conterminous United States. Precipitation averages about 100 inches annually over the basin, and ranges from about 25 inches in the western lowland to about 190 inches in higher parts of the Cascade Range, in the basin's upper reaches. Altitudes range from sea level at the Skagit River delta on the west to 10,773-foot Mt. Baker. Glacial and snowmelt waters provide sustained year-around streamflows in all major streams. This assures an abundant water supply for present and projected water uses in the basin including irrigation, industrial use, commercial and domestic supplies, lumbering, fishing, recreation, and hydroelectric power generation. Five major dams provide storage for power generation, flood control, and recreational use. Ground-water supplies are obtained principally from sand and gravel in valley alluvium, mostly in the lower Skagit River valley. Both surface and ground water are of good to excellent quality for most uses, although excessive concentrations of iron and extreme hard-

ness were found locally in ground water. (Woodard-USGS)
W79-04028

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1977.
Geological Survey, Anchorage, AK. Water Resources Div.
Geological Survey Water-Data Report AK-77-1, November 1978. 439 p, 11 fig.

Descriptors: *Alaska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 112 gaging stations, stage only records for 4 gaging stations, water quality for 60 stations, and water levels for 25 observation wells. Also included are 18 low-flow, 91 crest-stage, and 19 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (Woodard-USGS)
W79-04032

WATER RESOURCES DATA FOR MINNESOTA, WATER YEAR 1977--VOLUME 1. GREAT LAKES AND SOURIS-RED-RAINY RIVER BASINS.
Geological Survey, St. Paul, MN. Water Resources Div.
Geological Survey Water-Data Report MN-77-1, September 1978. 276 p, 2 fig.

Descriptors: *Minnesota, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Great Lakes, *Tributaries to Lake Superior, *Souris-Red-Rainy River basins.

Water resources data for the 1977 water year for Minnesota consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells and springs. This volume includes the Great Lakes and Souris-Red-Rainy River basins and contains discharge records for 79 gaging stations; stage only records for 1 gaging station; stage and contents for 4 lakes and reservoirs; water quality for 21 gaging stations, 2 partial-record flow stations, 4 lakes, and 65 wells; and water levels for 18 observation wells. Also included are 39 crest-stage partial-record stations and 35 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Minnesota. (Woodard-USGS)
W79-04036

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Chung Sang Chu, and C. E. Bowers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-290 885, Price codes: A13 in paper copy, A01 in microfiche. Water Resources Research Center, University of Minnesota, Bulletin 97. November 1977. 263 p. OWRT C-5111(No. 4227)(1), 14-31-001-4227.

Descriptors: *Computer programs, *Simulation models, *Simulation analysis, Water resources, Model studies, Information exchange, Reviews, Bibliographies.

The study is concerned with the many computer programs and simulation models in the field of water resources. The report consists of three parts. The first is a brief summary of information in this field and the sources of special interest. The second is a fairly detailed review of 28 programs of special interest and a brief review of 8 books in the same category. The third section is an annotated bibliography of about 390 computer programs and simulation models. (Waelti-Minn)
W79-04081

DETERMINATION OF THE TECHNICAL POTENTIAL OF THE LIME-MAGNESIUM CARBONATE PROCESS, VOLUME I,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 3A.
W79-04161

FORTRAN IV PROGRAM TO COMPUTE DIVERSITY INDICES FROM INFORMATION THEORY,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 10D.
W79-04262

FORTRAN IV PROGRAM TO COMPUTE REPLICATED DIVERSITY INDICES FOR RANDOM SAMPLES OF SPECIFIED SIZE,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 10D.
W79-04263

FORTRAN IV PROGRAM TO COMPUTE HIERARCHICAL DIVERSITY,
Kansas Univ., Lawrence. Dept. of Geology.
For primary bibliographic entry see Field 10D.
W79-04264

THE DYNAMICS OF THE COASTAL BOUNDARY WATERS OFFSHORE SOUTHERN NEW JERSEY,
Pandullo Quirk Associates, Wayne, NJ.
For primary bibliographic entry see Field 2L.
W79-04360

SOME PRACTICAL TECHNIQUES OF TWO-DIMENSIONAL INTERPOLATION IN COMPUTATIONAL HYDRAULICS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 8B.
W79-04368

ON NUMERICAL ACCURACY IN COMPUTATIONAL HYDRAULICS,
Texas A and M Univ., College Station. Dept. of Civil and Ocean Engineering.
For primary bibliographic entry see Field 8B.
W79-04369

EVALUATION OF A BARRIER AGAINST SEAWATER INTRUSION,
Los Angeles County Flood Control District, CA.
For primary bibliographic entry see Field 2L.
W79-04370

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 2. PACIFIC SLOPE BASINS FROM ARROYO GRANDE TO OREGON STATE LINE EXCEPT CENTRAL VALLEY.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 895, Price codes: A24 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CA-77-2, September 1978. 544 p, 3 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Pacific slope basins.

Volume 2 of water resources data for the 1977 water year for California consists of records of stage, discharge, and water quality of streams and wells; stage, contents, and water quality in lakes and reservoirs; and water levels in wells. This report contains discharge records for 164 gaging stations; stage and contents for 20 lakes and reservoirs; water quality for 195 stations and 16 wells; and water levels for 24 observation wells. Also included are 13 crest-stage partial-record stations and 139 low-flow partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04394

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 3. SOUTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM WALKER RIVER TO TRUCKEE RIVER.
Geological Survey, Menlo Park, CA. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-287 630, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report CA-77-3, September 1978. 379 p, 12 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Great Basin, *Walker River, *Truckee River, *Southern central valley basins.

Volume 3 of water resources data for the 1977 water year for California consists of records of stage, discharge, gage-height, and water quality of streams; stage contents, and water quality in lakes and reservoirs; and water levels in wells. This report contains discharge records for 180 gaging stations, stage and contents for 42 lakes and reservoirs, gage-height records for 2 lakes, and water quality for 47 stations, and water levels for 12 observation wells. Also included are 34 crest-stage partial-record stations, 35 low-flow partial-record stations, and 4 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as special investigations and miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04395

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 1. COLORADO RIVER BASIN, SOUTHERN GREAT BASIN FROM MEXICAN BORDER TO MONO LAKE BASIN, AND PACIFIC SLOPE BASINS FROM TIJUANA RIVER TO SANTA MARIA RIVER.
Geological Survey, Menlo Park CA. Water Resources Div.
Geological Survey Water-Data Report CA-77-1, November 1978. 638 p, 6 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Colorado

River basin, *Southern Great Basin, *Pacific slope basins.

Volume 1 of water resources data for the 1977 water year for California consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality in lakes and reservoirs; and water levels in wells in southern California. This report contains discharge records for 234 gaging stations, stage-only record for 3 gaging stations, stage and contents for 18 lakes and reservoirs, water quality for 72 stations and 2 wells, and water levels for 21 observation wells. Also included are 13 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04397

WATER RESOURCES DATA FOR CALIFORNIA, WATER YEAR 1977--VOLUME 4. NORTHERN CENTRAL VALLEY BASINS AND THE GREAT BASIN FROM HONEY LAKE BASIN TO OREGON STATE LINE.
Geological Survey, Menlo Park, CA. Water Resources Div.
Geological Survey Water-Data Report CA-77-4, October 1978. 425 p, 12 fig, 1 tab.

Descriptors: *California, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Northern central valley basins, *Sacramento River basin.

Volume 4 of the water resources data for the 1977 water year for California includes basins in the northern part of the State. This volume contains discharge records for 189 gaging stations, stage and contents for 31 lakes and reservoirs, precipitation data for 2 stations, water quality for 74 stations, and water levels for 3 observation wells. Also included are 23 crest-stage partial-record stations, 36 low-flow partial-record stations, and 7 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as special investigations and miscellaneous measurements. These data represent that part of the National Water Data system operated by the U.S. Geological Survey and cooperating State and Federal agencies in California. (Woodard-USGS)
W79-04398

INDEX TO WATER-RESOURCES DATA FOR LOUISIANA, GROUND-WATER RECORDS,
Geological Survey, Baton Rouge, LA. Water Resources Div.
S. L. Marshall.
Louisiana Department of Public Works Water Resources Basic Records Report No 9, 1978. 176 p, 75 fig, 3 tab, 15 ref.

Descriptors: *Indexing, *Water wells, *Water levels, *Water quality, *Louisiana, Groundwater, Observation wells, Well data, Aquifers, Maps, Wells, Sites.

This index is a listing of water wells, active and inactive, for which water-level and (or) water-quality data have been collected periodically and maintained by the U.S. Geological Survey in Louisiana. The listing is presented in tabular format and provides the station identification number, location, owner, depth, geohydrologic unit, type of data, current status or frequency, and period of record for 3,177 wells. Of these, about 780 wells form the basic network of the Geological Survey's current data-collection program. (Woodard-USGS)
W79-04412

8. ENGINEERING WORKS

8A. Structures

ELECTRIC POWER DEVELOPMENT IN THE PACIFIC NORTHWEST REGION: INSTITUTIONAL COMMITMENTS AND ALTERNATIVES, PHASE 2,
Washington Univ., Seattle. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6E.
W79-04159

IRRIGATION PIEP REPAIR CUTS COSTS,
R. Larsen.
Irrigation Age, Vol. 12, No. 7, p 6, April, 1978. 1 fig.

Descriptors: *Pipes, Repairing, *Costs, Colorado, *Equipment, Maintenance, Irrigation.

The experience of a Colorado farmer who designed a repair operation for damaged aluminum irrigation pipes was discussed. Repairing damaged pipes has proved to be considerably cost-effective in comparison to the costs for new pipes. (Skogerboe-Colorado State)
W79-04185

DRAIN-HOLE DRILLING CAN INCREASE PRODUCTIVITY,
EG and G Idaho, Inc., Idaho Falls.
S. M. Prestwich, and L. G. Miller.
World Oil, Vol. 187, No. 7, December 1978, p 69-71. 4 fig.

Descriptors: *Drilling, *Geothermal studies, *Deep wells, *Well production, Directional drilling, Cost-benefit analysis.

This paper describes one of the techniques used by the Raft River Geothermal Exploration (RRGE) project to decrease hot water production costs. A deep geothermal well was completed with three directionally drilled legs, or drain-holes. The two extra legs improved the well's production by 500%, from an initial rate of 80 gpm to 425 gpm. This fivefold increase in production was purchased for only 20% increase in drilling cost. Orientation of the directional string was achieved with a wireless orientation indicator with surface readout. Due to the high temperature in the legs (305 degrees F), rubber parts of the mud motor disintegrated. This problem may be avoided by using a high-temperature turbo-drill. It was found that increased production depends more on fracturing than on permeability or porosity. This technique will be used production wells and injection wells and will improve the overall economics of generating electricity using geothermal energy. (Purdin-NWWA)
W79-04249

WATER SYSTEM DESIGN FOR A LOW YIELD WELL,
Hanson Drilling Co., Inc., Vancouver, WA.
M. Sample.
Water Well Journal, Vol. 33, No. 1, p 41, January 1979. 1 fig.

Descriptors: *Water supply, *Water storage, *Water yield, Storage tanks, Pumps.

The design of an individual water supply system for a low yield well is presented. The key components of the system are a 1200 gallon reserve tank and a small pump to transfer water from the reserve tank to the storage tank. The additional cost of this system would vary depending on location and area, but it is approximately $1,000. A well with only one-half gpm yield would meet the normal daily domestic water requirement with 120 gallons to spare. (Purdin-NWWA)
W79-04250

BLASTING-IT TURNS DRY HOLES INTO WET ONES,
Universal Oil Products, St. Paul, MN. Johnson Div.
F. Driscoll.
The Johnson Drillers Journal, Vol. 50, No. 6, p 1-3, 13, November-December 1978.

Descriptors: *Drilling, *Explosives, *Well development, Water wells, Dry wells, Till, Crystalline rocks, Joints(Geologic), Fracture permeability.

Methods and tools for drilling wells faster and obtaining better yields in an area of crystalline rock overlain by bouldery till are described. Salvaging of dry wells in this area requires widening of horizontal joint systems so that they intercept vertical faults. The cost of hydraulic fracturing is prohibitive, but an inexpensive and effective method is the use of explosives. To maximize the blast effect in a horizontal direction, sand in used to cover the explosives. The sand also props open joints after the explosives. (Purdin-NWWA)
W79-04251

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME ONE: DESIGN DATA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
August 1977. 175 p, 41 fig, 6 tab, 42 ref, 15 append.

Descriptors: *Dams, *Dam design, *Damsites, Dam foundations, Concrete dams, Concrete technology, Aggregates, Pozzolans, Concrete additives, Foundations, Design considerations, Hydrologic data, Climatic data, Foundation testing, Placer County(California).

Background, general information, and the design data upon which Auburn Dam was based are presented in this first volume of a five volume series. Information is provided on: climatological data, hydrologic data, reservoir capacity and operation, site selection, and construction materials. Details of the in situ and laboratory tests used to investigate the foundation at Auburn are reviewed. Test procedures are described, and sample results are presented. The discussion on concrete properties includes a description of the preparation and testing of concrete samples from various combinations of the actual cements, pozzolans, water, and aggregates to be used in the dam and foundation. (See W79-04269 thru W79-04274) (Davison-IPA)
W79-04268

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME TWO: FOUNDATION STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
May 1978. 198 p, 48 fig, 7 tab, 16 ref, 9 append.

Descriptors: *Dams, *Dam foundations, *Foundation investigations, Stability, Finite element analysis, Analytical techniques, Slope stability, Shear, Rock properties, Safety factors, Structural stability.

The foundation analyses and treatment of Auburn Dam for both deformation and stability purposes are presented in this second volume of a five volume series. The properties of continuous shears and the effective modulus of rock masses are discussed. The Joint-shear index and the Shear catalog, two new techniques developed by the Bureau of Reclamation for determining the effective modulus, were used with conventional two-dimensional finite element programs to model the foundation characteristics and behavior under anticipated dam and reservoir loads. The foundation treatment was determined based on these deformation studies. The general procedure and the explorations and studies performed to determine modes for stability analysis are described; four stability modes are discussed. The methods of analysis to be used are presented, and the critical properties of

strength and continuity are determined. (See also W79-04268) (Davison-IPA)
W79-04269

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME THREE: STATIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
November 1977. 193 p, 111 fig, 18 ref.

Descriptors: *Concrete dams, *Arch dams, *Design criteria, *Design specifications, *Dam design, Stress analysis, Structural design, Structural analysis, Mathematical studies, Finite element analysis.

The structural design and static analysis of Auburn Dam are discussed in the third volume of a five volume series. A general discussion of the various types of dams, the advantages and disadvantages of each, and the reasons for the selection of a concrete double curvature arch dam is followed by an outline of the overall process of concrete arch dam design and layout. The final design for Auburn Dam is presented and the criteria applied to the design is discussed along with additional data which was not presented in Volume I, Design Data. The six different mathematical and physical model analyses used to study the stresses in the dam are examined, and the results are compared and evaluated with regard to the design criteria. (See also W79-04268) (Davison-IPA)
W79-04270

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FOUR: DYNAMIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
April 1978. 104 p, 46 fig, 4 tab, 60 ref.

Descriptors: *Earthquake engineering, *Seismic design, *Structural design, *Design criteria, Concrete dams, *Dam design, Structural stability, Safety factors, Arch dams, Dynamics, Seismic studies, Stress analysis, Structural analysis.

The details and results of six dynamic studies performed for the Auburn Dam are reported in the fourth volume of a five volume series on the Auburn Dam. Selected natural or artificially generated earthquake accelerations were mathematically applied to the dam structure as statically designed. Three earthquakes, the Operating Basis Earthquake, the Design Basis Earthquake, and the Maximum Credible Earthquake, are defined, and the allowable structural response to each is discussed. Specific loading criteria, the specific earthquake studies for the Auburn site and their response spectra and accelerograms are examined. Thrust block and water barrier, the methods of analysis used in the dam studies are described. The results of the six studies are tabulated and significant stresses at different locations in the dam are considered. These results are compared and the significance of specific stresses to the dynamic performance of the dam are evaluated. (See W79-04268) (Davison-IPA)
W79-04271

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FOUR SUPPLEMENT: DYNAMIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
November 1977. 450 p.

Descriptors: *Concrete dams, *Arch dams, *Data collections, Structural design, Safety factors, Curves, Analytical techniques, Auburn Dam, Placer County(California), Loads(Forces), Earthquake engineering, Seismic design.

Part of the computer results for the six dynamic studies made for Auburn Dam and normalized model displacement curves for 30 modes determined at four elevations throughout the dam are presented in this supplement to Volume IV of a series on Auburn Dam. (See also W79-04268) (Davison-IPA)
W79-04272

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FOUR APPENDICES: DYNAMIC STUDIES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
November 1977. 369 p, 2 append.

Descriptors: Concrete dams, *Arch dams, *Stress analysis, Data collections, Structural analysis, Seismic design, Earthquake engineering, Loads(forces), Dams, Dam design.

Appendices A and B to Volume IV, Dynamic Studies, of a series on Auburn Dam are presented. Appendix A consists of principal stress plots for the six dynamic studies conducted, and Appendix B contains element stress histories for five of the six studies. (See also W79-04268)
W79-04273

DESIGN AND ANALYSIS OF AUBURN DAM, VOLUME FIVE: SUMMARY AND CONCLUSIONS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
M. Arai, H. L. Boggs, G. F. Bowles, K. J. Dreher, and M. A. Kramer.
June 1978. 31 p, 5 fig.

Descriptors: *Concrete dams, *Arch dams, *Auburn Dam, Design data, Dam sites, Dam foundations, Earthquakes, Seismic design, Foundation investigations, Construction materials, Stress analysis, Loads(Force), Analytical techniques.

An executive summary of the preceeding four volumes on the Design and Analysis of Auburn Dam is presented. Each chapter in this volume corresponds to the other volumes in the series, and presents the significant conclusions of each. The contents of the preceding volumes are listed. (See also W79-04268)(Davison-IPA)
W79-04274

THE CAP - AN ENGINEERING MARVEL,
Arizona Society of Professional Engineers, Phoenix.
R. Johnson.
Arizona Professional Engineer, Vol. 30, No. 7, p 8-9, July 1978. 3 fig.

Descriptors: *Canal construction, *Canal design, *Central Arizona Project, *Water conveyance, Water management(Applied), Arizona.

With water deliveries scheduled to begin in the mid 1980's, the Central Arizona Project (CAP) is coming closer to reality every day. Aspects of the design and construction of the canal are described here to illustrate that this system is not only an engineering marvel but also a tribute to Arizonans who refused to give up the fight for better management and conservation of their state's meager water resources. Although the construction materials and installation equipment represent the peak of modern scientific achievement, the most obvious evidence of technological progress is the canal itself. With 90 miles already completed, work is now concentrating on the Granite Reef segment of this canal which will eventually stretch from Lake Havasu at Parker Dam to Tucson, a distance of approximately 300 miles. The history, construction and design criteria of this engineering marvel which will carry 2.2 million acre feet of water are described while illustrating the critical water problem that will be greatly alleviated upon completion of the system in mid 1980's. (Tickes-Arizona)
W79-04294

SPILLWAY STILLING BASIN FOR LOW FROUDE FLOWS,
Bureau of Reclamation, Denver, CO.
For primary bibliographic entry see Field 8B.
W79-04355

FLOW PATTERNS AROUND SUBMERGED INTAKE STRUCTURES FOR POWER PLANTS,
United Engineers and Constructors, Inc., Philadelphia, PA. Hydraulics Group.
K. S. Satija, and Y. B. Dai.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Specialty Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 37-57, 1977. 6 fig, 3 ref.

Descriptors: *Intakes structures, *Flow, *Model studies, *Hydraulic structures, Mathematical models, Hydraulic models, Distribution patterns, Spatial distribution, Currents(Water), Theoretical analysis, Analytical techniques, Potential flow.

In order to investigate the velocity field around the intake structures, a theoretical study was initiated based on the theory of potential flow of sinks and method of images. In this study, each intake was simulated as a circular line sink with a diameter equal to that of the intake head. The computer program POTVEL-II was developed for calculating the values of potential functions at any desired point around the intakes, and the equipotential lines can be drawn from them. Based on these lines, the streamlines can be plotted considering that streamlines are orthogonal to equipotential lines and form a network pattern. By virtue of these lines, flow net in the flow field near the intakes can be constructed. The magnitude and directions of velocity at any desired point in the flow field can be determined thereafter. Hydraulic model tests also were conducted for an intake structure. The results obtained from the analytical model and the physical model agree fairly well. It was concluded that the analytical model POTVEL-II is a competent tool to predict the velocity distribution around the intake structures. (See also W79-04351) (Humphreys-ISWS)
W79-04356

INTAKE SCREENWELL SURGING CAUSED BY WAVE DYNAMICS,
Stone and Webster Engineering Corp., Boston, MA.
Y. J. Tsai, Y. C. Chang, and D. M. Crocker.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Specialty Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 58-65, 1977. 5 fig, 3 ref.

Descriptors: *Waves(Water), *Surges, *Intakes structures, *Model studies, Dynamics, Fluid mechanics, Analytical techniques, Analysis, Mathematical models, Equations, Unsteady flow, Coastal structures.

An intake screenwall surge mathematical model was developed for an intake chamber both directly leading to the open water and indirectly leading to the open water through a certain length of conduit. Continuity and momentum equations were solved for the water body in the intake system. Special considerations were given to the vertical acceleration of water column and the wave characteristics at the opening of the intake structure. The energy flux of inletting water and the maximum interior flood level are functions of the opening dimension, size of the chamber, submergence of the opening, length of the connecting conduit, and the design wave characteristics. Intake chambers subject to surging to floor levels must have analyses to verify adequacy of venting. (See also W79-04351)(Humphreys-ISWS)
W79-04357

POWER GENERATION AND POTABLE WATER RECOVERY FROM SALINOUS WATER,
Universal Oil Products Co., Des Plaines, IL. (Assignee).
For primary bibliographic entry see Field 3A.
W79-04468

8B. Hydraulics

GREEN RIVER BASIN SYSTEMS MODELS - DEVELOPMENT OF SIX-HOUR FLOW RECORDS,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04008

GREEN RIVER DATA BASE SYSTEM,
Purdue Univ., Lafayette, IN. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W79-04009

THE EFFECTS OF UNSTEADY POTENTIAL FLOW ON HEATED LAMINAR BOUNDARY LAYERS IN WATER: FLOW PROPERTIES AND STABILITY,
Rand Corp., Santa Monica, CA.
W. S. King, J. Aroesty, L. S. Yao, and W. Matyskiela.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A047 711, Price codes: A03 in paper copy, A01 in microfiche. Report No. R-2164-ARPA, November 1977. 28 p, 6 fig, 2 tab, 15 ref. DAHC15-73-C-0181.

Descriptors: *Boundary layers, *Stability, *Theoretical analysis, *Laminar flow, *Unsteady flow, Fluid mechanics, Analysis, Heated water, Equations, Reynolds number, Laminar boundary layers, Differential equations.

The effects of unsteadiness and the stability of boundary-layer flows as governed by the Orr-Sommerfeld equation were discussed. The condition required for validity of the quasi-steady approximation of governing flow equations is that the ratio of diffusion time to flow time should be small. It also was shown that criteria for validity of the quasi-steady approximation of the Orr-Sommerfeld equation are based on modifications of this ratio and are not nearly as stringent. Examples of heated wedge flows in water that were presented and discussed showed the profound effect of even slowly varying unsteadiness on both laminar boundary-layer flow and its stability. (Adams-ISWS)
W79-04046

SELECTIVE WITHDRAWAL FROM TWO-LAYER FLUID,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
I. R. Wood.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 104, No. HY12, Proceedings Paper 14263, p 1647-1659, December 1978. 7 fig, 14 ref, 2 append.

Descriptors: *Discharge(Water), *Cooling water, *Withdrawl, Laboratory tests, Fluid mechanics, Hydraulics, Reservoirs, Stratified flow, Stratification, Flow, Velocity, Theoretical analysis, Thermal stratification, Civil engineering, Cooling ponds.

The discharge from a stably stratified reservoir is set by a valve, but the quality of the water and the flow pattern near the valve is determined by the interaction of the stratification and the geometry of the reservoir. In a two-layered system, this control is at a single section. In previous work in this area, the gradually varied flow assumption was made. In this paper it was shown that an alternative assumption, i.e., at the critical section (the virtual control) the velocity field in each layer is radial, with velocities in each layer that are only functions of the radial distance, yields a simple theory. This theory gives, for a particular discharge and given upstream conditions, the ratio of the discharge from each layer. It is applicable to the practical cases where the flow is not gradually varied. Experimental results were presented which support the theory. (Sims-ISWS)
W79-04123

SPILLWAY STILLING BASIN FOR LOW FROUDE FLOWS,
Bureau of Reclamation, Denver, CO.
R. L. George.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 28-36, 1977. 5 fig, 5 ref.

Descriptors: *Energy dissipation, *Spillways, *Hydraulic models, *Hydraulic design, Froude number, Hydraulic structures, Hydraulics, Laboratory tests, Basins, Design criteria, Flow characteristics, Analysis, Hydraulic jump.

Limited water supplies are currently available in most coastal areas to meet municipal and industrial demands. As these areas continue to grow, additional water supplies must be developed to meet their needs. Diversion structures and low head dams will be built as part of these expanded water supplies. Typically, these structures are comparatively low and their spillways will operate at low Froude numbers. Palmetto Bend Dam stilling basin is an example of a low Froude number structure modeled recently in the Bureau of Reclamation Hydraulic Laboratory, and the recommended design is quite different from available low Froude number designs. As a result, hydraulic model investigations were performed to develop a design that would be suitable for a low Froude number stilling basin. The design developed during these studies usually will be adequate without model tests, unless approach or outlet flow is asymmetrical or unless testing is needed to develop a smaller stilling basin. Some of the criteria developed from this model study were location, size and type of baffle piers, chute blocks, end sills, length of the basin, and tailwater depth. The above criteria and guidelines from previous studies were combined to formulate the design guidelines recommended for the low Froude number hydraulic jump stilling basin. (See also W79-04351) (Humphreys-ISWS)
W79-04355

FLOW PATTERNS AROUND SUBMERGED INTAKE STRUCTURES FOR POWER PLANTS,
United Engineers and Constructors, Inc., Philadelphia, PA. Hydraulics Group.
For primary bibliographic entry see Field 8A.
W79-04356

IMPROVED DRAG FORCE LINEARIZATIONS FOR STRUCTURAL DYNAMIC CALCULATIONS,
McDermott (J. Ray) Co., Inc., New Orleans, LA.
M. J. Mes.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 66-72, 1977. 1 fig, 2 ref.

Descriptors: *Drag, *Mathematical models, *Hydraulic structures, *Wave(Water), Coastal structures, Model studies, Analytical techniques, Dynamics, Loads(Forces), Analysis, Frequency analysis, Fourier analysis, Spectral density function.

In the non-deterministic dynamic analysis of offshore structures, the drag force is linearized. This is necessary because if otherwise, calculation methods from the field of spectral statistics cannot be applied to obtain calculation results. Present linearization procedures ignore higher frequency force harmonics produced by the regular drag force. These are important because these higher frequencies can cause resonant motion of deep water structures. A new linearization procedure was presented (based on a Fourier expansion) which causes the higher force frequencies to be included in the structural dynamic calculations. (See also W79-04351)(Humphreys-ISWS)
W79-04358

MINIMIZING WAVE TRANSMISSION THROUGH JETTIED INLETS,
Worcester Polytechnic Inst., Holden, MA. Alden Research Lab.
For primary bibliographic entry see Field 2H.
W79-04363

SOME PRACTICAL TECHNIQUES OF TWO-DIMENSIONAL INTERPOLATION IN COMPUTATIONAL HYDRAULICS,
Geological Survey, Reston, VA.
C. Lai.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 169-178, 1977. 4 fig, 7 ref.

Descriptors: *Hydraulics, *Numerical analysis, *Analytical techniques, *Mathematical studies, Approximation method, Flow, Model studies, Equations, Computer models, Two-dimensional flow, Method of characteristics, Finite difference analysis.

The numerical simulation of hydraulic problems often requires the use of various interpolation techniques. An interpolation can be achieved by finding a curve (surface) that represents the given data points, approximating the curve (surface) by function(s), and finally evaluating the function value at a desired point (interpolation point). In this paper, applications of a few truncated forms of the two-dimensional (2-D) Taylor series to interpolation of both function values and function derivatives in some x-y grid systems were shown. Various schemes were developed subsequently for interior points, edge points, and salient and reentrant corner points of a schematized 2-D flow region. Numerical experiments and applications have shown favorable results, indicating that further exploration is worthwhile. There remains plenty of room for improvement in interpolation in computational hydraulics. Other techniques, such as bicubic spline functions, also must be investigated. Furthermore, sound engineering judgment must always be used in performing such interpolation. (See also W79-04351)(Humphreys-ISWS)
W79-04368

ON NUMERICAL ACCURACY IN COMPUTATIONAL HYDRAULICS,
Texas A and M Univ., College Station. Dept. of Civil and Ocean Engineering.
D. R. Basco.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 179-186, 1977. 3 fig, 10 ref, 2 append.

Descriptors: *Hydraulics, *Numerical analysis, *Analytical techniques, *Mathematical studies, Approximate method, Estimating, Analysis, Methodology, Flow, Equations, Calibrations, Finite differences analysis.

Finite-difference methods remain a popular and powerful technique to solve numerically the fundamental flow equations of hydraulics on the computer. Because all numerical methods are approximations, the question of relative inaccuracies resulting from the machine computations must be considered. Fortunately, theoretical methods do exist to estimate the amplitude and phase errors that occur in the propagation problems of engineering concern, e.g., river flooding routing, tidal hydraulics, etc. The purposes of this paper were

(1) to review these methods, (2) to show how the calculations can be readily made for any finite-difference scheme, and (3) to discuss their implications when applied to engineering and research problems. A recipe can be written for any scheme so that accuracy portraits (both amplitude and phase) can be computed easily. Although not exact, these portraits give insight into the proper grid and time spacings to employ, into whether implicit schemes are worthwhile, and other factors to insure a desired accuracy in the computations. For simulation and modeling applications, these concepts will permit more physically realistic calibration and verification phases of the prototype. (See also W79-04351) (Humphreys-ISWS)
W79-04369

THE STABILITY OF A TWO LAYER FLOW WITHOUT SHEAR IN THE PRESENCE OF BOUNDARY GENERATED TURBULENCE: FIELD VERIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
S. C. McCutcheon, and R. H. French.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 212-219, 1977. 3 fig, 2 tab, 9 ref.

Descriptors: *Stratified flow, *Flow profiles, *On-site investigations, *Boundary processes, Interfaces, Turbulent flow, On-site data collections, Analytical techniques, Analysis, Density currents, Density stratification, Velocity, Mixing, Flow, Flow stability, Shear velocity, Layered flow.

It was the purpose of this paper to examine the question of interfacial stability in the presence of boundary generated turbulence and to present field data which verify previous laboratory experiments. Field measurements were made downstream of the Cumberland Steam Plant near Cumberland City, Tennessee, over a period of 8 months. Previous studies of thermal plumes at Widows Creek, John Sevier, and New Johnsonville Steam Plants yielded additional data. Conclusions drawn for the field and laboratory data were: (1) although the plotted field and laboratory data do not overlap, there is a consistency between the respective flow regions of stable, transitional and unstable flow; (2) the field data lie in bands with the position of the band determined by the value of the parameter (shear velocity)/(average velocity). The value of this parameter increases from left to right. In general, these bands slope upward from left to right. Within a band, the Reynolds Number varies only slightly, but the change in density (delta rho) increases from left to right. Thus, it seems that for a given value of (shear velocity)/(average velocity), delta rho can be increased to such a level that the turbulent eddies cannot overcome the stratification and the interface is stable. It was suggested that since the results were not conclusive, future investigations should be controlled laboratory experiments where (shear velocity)/(average velocity) can be varied over a wide range. (See also W79-08140)and W79-04351) (Humphreys-ISWS)
W79-04372

MODIFICATION OF THE CHEZY ROUGHNESS COEFFICIENT BY DENSITY STRATIFICATION,
Vanderbilt Univ., Nashville, TN. Dept. of Hydraulic and Water Resources Engineering.
R. H. French.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 220-227, 1977. 5 fig, 1 tab, 5 ref.

Descriptors: *Stratified flow, *Roughness coefficient, *Open channel flow, *Density stratification, Chezy equation, Hydraulics, Flow, Roughness(Hydraulics), Theoretical analysis, Analytical techniques, Flow characteristics, Mathematical models.

Basic to all analysis of open channel flow, steady or unsteady, is the necessity of computing the losses due to shear at the boundaries. In the past, this has been done by estimating the Chezy roughness coefficient, C, and using the Chezy uniform flow equation. Recent theoretical and experimental work by the author indicated that in a stratified flow, C is not only a function of the Reynolds number and the boundary roughness, but also a function of the density gradient. It should be noted that the experiments discussed were neither designed nor intended to verify the theoretical analysis; however, they do serve for initial verification. From the hypotheses and experimental data discussed, it is clear that density stratification can modify significantly the value of the Chezy roughness coefficient. In many cases, a simple linearization of the density gradient may provide a much improved estimate of C. However, it must be noted that the experiments described are limited, and thus the results of this work cannot be considered completely verified. (See also W79-04351) (Humphreys-ISWS)
W79-04373

VELOCITY DISTRIBUTION AND SEDIMENT MOTION INDUCED BY SHIP'S PROPELLER IN SHIP CHANNELS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Y-C. Liou, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p. 228-235, 1977. 2 fig, 1 tab, 7 ref.

Descriptors: *Sediment transport, *Canals, *Navigation, *Model studies, Mathematical models, Numerical analysis, Channels, Analytical techniques, Analysis, Bed load, Movement, Saltation, Velocity, Distribution patterns, Theoretical analysis.

A numerical model using the momentum theory of the propeller and Shields' diagram was developed to study sediment movement induced by a ship's propeller in a restricted waterway. The velocity distribution downstream of the propeller was simulated by the Gaussian normal distribution function. The shear velocity and shear stress were obtained using Sternberg's formulas. Once the ship's speed, depth of the waterway RPM and diameter of the propeller, and draft of the ship are given, the velocity distribution and the grain size of the initial motion could be obtained from this model. Case studies were presented to show the influence of significant factors on sediment movement at the channel bottom induced by a ship's propeller. (See also W79-04351) (Humphreys-ISWS)
W79-04374

THE SQUAT PHENOMENON AND RELATED EFFECTS OF CHANNEL GEOMETRY,
Army Engineer District, Galveston, TX.
E. T. Gates, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 236-244, 1977. 6 fig, 4 ref.

Descriptors: *Navigation, *Canals, *Hydraulics, *Flow characteristics, Channel flow, Channels, Boundary layers, Flow around objects, Flow, Ships, Movement, Inland waterways, Ship squat, Channel effects.

A vessel entering a restricted waterway is acted on by and reacts to a number of physical phenomena. These phenomena cause the ship to settle, to be pulled to the near bank, and to react to wind and current forces tending to skew the ship in the channel. Also, the waves and surges generated by the ship can be very dangerous to other craft, shore structures, and channel banks. Consideration of the effects of these phenomena must be included in navigation channel design and review procedures. Ship settling phenomenon and the effects of the naturally formed portion of a dredged navigation channel cross section were discussed. Squat is a function of the speed of the vessel, the cross-sectional area of the vessel, the cross-section area of the channel, and the location of the vessel's sailing line with respect to the centerline of the channel. Boundary layers tend to increase the effective cross-sectional area of the vessel and decrease the effective cross-sectional flow area of the channel, and they should be taken into consideration in determining the squat of the vessel. Design procedures should include the analysis of the design channel in its natural environment throughout the entire length of the channel. (See also W79-04351). (Humphreys-ISWS)
W79-04375

MAJOR PORT IMPROVEMENT ALTERNATIVES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
J. W. Berriman, and J. B. Herbich.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 245-252, 1977. 2 fig, 5 tab, 11 ref.

Descriptors: *Navigation, *Canals, *Transportation, *Harbors, Canal design, Ships, Channels, Open channels, Depth, Width, Dimensions, Design criteria.

Navigation facilities must be designed for good control and safe maneuvering of ships. The width, depth, and alignment of channels, and dimensions of maneuvering areas must be adequate for safe navigation but not excessive. The following channel design criteria are necessary to provide for the safe navigation of VLCC's and ULCC's, (1) Channel Width; Maneuvering Lane (A) = 2.0 x Beam + L sin 10 deg where L sin 10 deg applies for channels with strong yawing forces, Bank Clearance Lane (B) = 1.5 x Beam, Ship Clearance Lane (C) = 1.0 x Beam, One-way Traffic Width = A + 2B, and Two way Traffic Width = 2A + 2B + C. (2) Channel Depth; Channel Depth in Inner Channel = f(loaded draft, squat, and minimum keel clearance), Channel Depth in Outer Channel = (loaded draft, effect of pitch and roll, and minimum keel clearance) where effect of roll and pitch = L/2 sin one deg. (See also W79-04351). (Humphreys-ISWS)
W79-04376

DIFFRACTION OF WAVES BY A SHORE-CONNECTED BREAKWATER,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
V. W. Harms.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 253-260, 1977. 5 fig, 9 ref.

Descriptors: *Waves(Water), *Breakwaters, *Hydraulic structures, *Model studies, Coastal structures, Shores, Hydraulic models, Laboratory tests, Analysis, Shore protection, Wave diffraction.

Laboratory tests were performed for a breakwater with and without a wave-splitter plate and waves normally incident upon the breakwater. The influence of a wave-splitter plate and wave reflections from the seaward side were investigated in comparative tests performed both in the intermittent and continuous data-acquisition modes. for the range of conditions investigated, the following conclusions can be made: (1) In general, there is satisfactory agreement between measurement and theory. However, diffraction theory was not found to be conservation because at large distances in the shadow zone, measured wave-heights consistently exceed theoretical values. Close to the breakwater outside the shadow zone, the measured maximum wave-height is again larger than predicted by theory. (2) The influence of a wave-splitter plate is

only detectable within a radius of aproximately four wavelengths from the tip, and even here the affect is minor. (3) The diffraction behavior appears to be insensitive to the intensity of wave reflections from the seaward side of the breakwater. (4) The 2-dimensional motion of a wide wave generator produced highly 3-dimensional long-crested waves that could not be explained in terms of a 3-dimensional linear wave generator theory. (5) The 3-dimensional incident wave field must be described with sufficient detail in order to permit interpretation of the diffraction profiles as the wave-response to the presence of a given structure. (See also W79-04351). (Humphreys-ISWS)
W79-04377

A GENERALIZED POINT-VELOCITY METHOD FOR DISCHARGE COMPUTATIONS IN TIDAL WATERWAYS,
Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
For primary bibliographic entry see Field 2L.
W79-04378

BIOLOGICAL AND ENGINEERING INVESTIGATION OF ANGLED FLUSH FISH DIVERSION SCREENS,
Stone and Webster Engineering Corp., Boston, MA. Environmental Engineering Div.
For primary bibliographic entry see Field 8I.
W79-04383

8C. Hydraulic Machinery

GROUND-HEAT-ASSISTED HEAT PUMPS,
E. F. Lindsley.
Popular Science, Vol. 214, No. 2, p 98-100, February, 1979.

Descriptors: *Heat pumps, *Thermal storage, *Plastic pipes, Solar panels, Water wells, Air conditioning.

Dr. James E. Bose, of Oklahoma State University, has designed and tested a heat pump system which stores waste hot water in an earth coil made of PVC. Such a system avoids the problems that plague air-source heat pumps due to variations in air-temperature. In the summer, hot water from air conditioners and solar panels is stored in the earth coil during the day and recirculated through the solar panels during the night to cool. During the winter the stored hot water increases the efficiency of the heat pump. The advantage of using earth coils in place of an underground storage tank is that they have more surface area for a given volume of water to store or deliver heat. An alternative to the earth coil is a vertical coil in a water well. Such a well does not have to produce an adequate supply of potable water since it houses the coil and water is not pumped from it. Bose's system is dependent on a moderate climate since frost would damage earth coils, and air conditioners and sunlight would provide little heat in northern climates. (Purdin-NWWA)
W79-04243

TAILORING A PUMP FOR FARM USE,
For primary bibliographic entry see Field 4A.
W79-04245

HEAT PUMP UPDATE.
For primary bibliographic entry see Field 6B.
W79-04246

8G. Materials

MASS TRANSFER IN NONUNIFORM PACKING,
Auburn Univ., AL. Dept. of Chemical Engineering.
A. Y. Tan, B. D. Prasher, and J. A. Guin.
AICHE Journal (American Institute of Chemical Engineers), Vol. 21, No. 2, p. 396-397, March 1975. 2 fig, 1 tab, 7 ref.

Descriptors: *Mass transfer, *Packed beds, Ergun equation, Size distribution.

A study was conducted on the effects of a randomly distributed nonuniform particle size upon the fluid-solid transfer coefficients. Reliable results can be obtained in such mass transfer runs by employing the hydraulic mean diameter from the Ergun equation when computing fluid-particle transfers in nonuniform packing.
W79-04127

ASPHALT-CRUMB RUBBER WATERPROOFING MEMBRANE,
Arizona Water Resources Research Center, Tucson.
R. K. Frobel, R. A. Jimenez, C. B. Cluff, and G. R. Morris.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 104, No. IR1, p 43-58, March, 1978. 10 fig, 1 tab, 11 ref, 4 equ, 1 append.

Descriptors: *Linings, *Reservoir leakage, *Seepage control, Waterproofing, Asphaltic concrete, Laboratory tests.

A mixture of asphalt cement mixed with crumb-rubber (asphalt-rubber) has been used successfully in highway construction for several years in Arizona and other states. This paper describes laboratory tests on asphalt-rubber and includes preliminary results of an actual reservoir lining application. (Skogerboe-Colorado State)
W79-04182

8H. Rapid Excavation

BLASTING-IT TURNS DRY HOLES INTO WET ONES,
Universal Oil Products, St. Paul, MN. Johnson Div.
For primary bibliographic entry see Field 8A.
W79-04251

8I. Fisheries Engineering

HYDRAULIC RESTORATION OF STREAM GRAVEL FOR SPAWNING AND REARING OF SALMON SPECIES,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
W. C. Mih.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-292 149, Price codes: A03 in paper copy, A01 in microfiche. State of Washington Water Research Center, Washington State University Technical Report, September 1978. 35 p, 13 fig, 10 tab, 8 ref. OWRT A-095-WASH(1), 14-34-0001-8051.

Descriptors: Anadromous fish, Salmon, *Spawning, *Spawning beds, Hydraulic excavation, Jets, Fisheries, Gravel, *Silt.

The removal of silt from the spawning beds of Pacific salmon can greatly increase the survival rate of salmon eggs. Research has shown that egg survival is expected to increase from 10 percent for uncleaned beds to 40 percent after cleaning operations. In view of the expected success of silt removal, attempts to develop methods capable of removing fine material from salmon spawning beds have been undertaken by various agencies. The use of water jets to flush out the fine material which is then removed by a suction system has been considered to hold the most promise. As a result, experimentation was conducted to determine the optimum operating condition for the use of hydraulic jets in the removal of silt from the salmon spawning beds. Results from the testing program clearly indicate the use of hydraulic jets is an efficient means of silt removal. For instance, a one inch diameter jet operating at 70 feet per second can remove the silt from the gravel 19 inches below the streambed surface. The testing program is continuing one more year to determine the cleaning efficiency of a moving jet with various configurations of suction hoods. This information has generated interest at the Washington State Department of Fisheries for the use of hydraulic jets in the design and construction of a full scale gravel cleaning machine.
W79-04260

DESERTIFICATION, DEVELOPMENT, AND THE 'ADMIRALS' OF MANCHAR LAKE IN SIND, PAKISTAN,
Wilfred Laurier Univ., Waterloo (Ontario).
K. Hewitt.
Economic Geography, Vol. 53, No. 4, p 358-363, Oct. 1977. 22 ref.

Descriptors: *Fishing, *Lake morphology, *Lake, *Fish management, *Fish farming, *Desertification, Fisheries, River flow, Stream improvement, Water utilization, Lake basins, Flow duration, River basin development, Carrying capacity, Fish populations, Environmental effects, Arid lands, Pakistan.

The fishermen of Pakistan's Sind Province who use the large inundation lake, Manchar, are analyzed here to illustrate the specific responses to increased aridity of the people outside or marginal to the urban-oriented, commercial economy and to point out the tremendous cultural and environmental complexities of desertification problems. Fishing has been a wide-spread human adaptation in the desert regions of the old world and ephemeral lakes and rivers have played a large role in the economy of certain desert people. The plight of the present day Sind Province fishermen illustrates the unique and highly constrained adjustments necessary for inhabitants of coastal deserts. The Manchar is essentially a seasonal lake, providing irrigation water during expansion and arable lake floor land when constricted. There is a point, however, when the lake becomes too small, limiting fish and carrying capacity potential and bringing about overcrowding and eventual drying out of the lake. Considerable uncertainty during lake contraction is often aggravated by climatic stress such as the disastrous flood of 1975, and poor human management has created dangerous levels of soil and water salinity. (Tickes-Arizona)
W79-04292

FISH RETURN SYSTEMS,
Stone and Webster Engineering Corp., Boston, MA. Environmental Engineering Div.
Y. G. Mussalli, and E. P. Taft, III.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 288-295, 1977. 4 fig, 10 ref.

Descriptors: *Fish handling facilities, *Hydraulic structures, *Conveyance systems, *Hydraulic systems, Fish barriers, Fish passages, Pumps, Bypasses, Hydraulic equipment, Jet pumps, Lift baskets, Centrifugal fish pumps, Screw pumps, Air lift pumps.

As a result of present regulatory requirements for the protection of fish at cooling water intakes, several power plant intakes are being designed to incorporate fish protection facilities and transportation systems to return live fish to their natural environment. Fish protection can be based in principle on three different concepts: fish collection and removal, fish diversion, and fish deterrence. The first two concepts require systems to return collected or diverted fish from circulating water systems to their natural environment. The third concept involves exclusion of fish prior to entering an intake. This paper described, in general, important parameters which should be considered in designing each element of various fish transport systems. These systems included bypasses, pumps, and lift baskets. (See also W79-04351)(Humphreys-ISWS)
W79-04381

FISH SCREENING-THE STATE OF THE PRACTICAL ART,
Burns and Roe Construction Corp., Paramus, NJ.
R. T. Richards.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 296-303, 1977. 7 fig.

Descriptors: *Fish handling facilities, *Fish barriers, *Hydraulic structures, *Reviews, Fish management, Conveyance structures, Hydraulic systems, Intakes structures, Screens, Trash racks, Fish passages.

This paper was a progress report on the investigation of the ASCE Task Committee on Fish-handling Capabilities of Intake Structures into presently available practical devices or systems for protecting fish at water intakes. The emphasis was on the term 'practical', limiting the discussion to technology which consists of readily available and proven components and which has consistantly demonstrated the ability to reduce fish mortality. This particular presentation was limited to the primary fish screening, fish guiding, and fish repulsion techniques. The 'practical' device or systems discussed are substantially effective in protecting fish, are available today without further mechanical development, can be operated at reasonable cost, and can be maintained without interfering with the very high availability factor required of power plant cooling water supplies. The technology must be of proven mechanical reliability. We shold keep in mind that for power plants the water intake must function at full capacity 24 hours a day, 7 days a week. (See also W79-04351)(Humphreys-ISWS)
W79-04382

BIOLOGICAL AND ENGINEERING INVESTIGATION OF ANGLED FLUSH FISH DIVERSION SCREENS,
Stone and Webster Engineering Corp., Boston, MA. Environmental Engineering Div.
E. P. Taft, III, and Y. G. Mussalli.
In: Hydraulics in the Coastal Zone; Proceedings of the 25th Annual Hydraulics Division Speciality Conference, Texas A and M University, College Station, August 10-12, 1977. American Society of Civil Engineers, New York, p 304-312, 1977. 4 fig, 1 tab, 4 ref.

Descriptors: *Fish barriers, *Intakes structures, *Model studies, *Hydraulic structures, Bypasses, Screens, Fish management, Fish passage, Hydraulic models, Laboratory tests, Prototypes, Fish diversion screens.

This paper discussed the development of angled, flush-mounted, traveling screens which can be used to divert fish to bypasses without power plant intake screenwells. Although angled screens have not been utilized at power plants, they have been shown to be effective at hydroelectric facilities. Laboratory physical model studies with live fish were carried out to develop and optimize the design of the screen within the constraints imposed for power plant application. Utilizing information obtained, design criteria for effective application were established and the angled screen fish diversion system was incorporated into two power plant screenwells. On the basis of the development efforts, it appears that the angled, flush-mounted traveling screen concept may have the potential for diverting fish at other selected power plant intakes. (See also W79-04351)(Humphreys-ISWS)
W79-04383

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

ASCE MET SECTION STRIVING TO MAKE CIVIL ENGINEERING CURRICULA MORE PRACTICE-ORIENTED,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
R. P. Khera.
Civil Engineering, Vol. 48, No. 1, p 75, January, 1978.

Descriptors: Civil engineering, Engineering education, Education, Evaluation.

Concerned with deficiencies in civil engineering education and the limitations of the ECPD evaluation procedures, the ASCE Metropolitan Section Committee on Engineering Education set out to upgrade and monitor civil engineering education. A poll of Met Section members showed a desire for change in the direction of civil engineering education. Experimental review program of undergraduate civil engineering education was approved by the Met Section Board in April, 1968. It contemplated periodic visits to each of the undergraduate civil engineering departments in the Metropolitan area by a team of ASCE members. This article discusses in brief about the activities of the ASCE Met Section, the purpose it has served, and the procedure it follows to attain its objectives. (Skogerboe-Colorado State)
W79-04189

9C. Research Facilities

BALANCING THE INTERESTS. THE THIRD UN-LAW OF THE SEA CONFERENCE - (7TH SESSION),
For primary bibliographic entry see Field 6E.
W79-04441

10. SCIENTIFIC AND TECHNICAL INFORMATION

10A. Acquisition And Processing

STATUS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX)--SEPTEMBER 1978,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards.
Geological Survey open-file report 79-330, 1979. 11 p, 3 tab, 8 ref.

Descriptors: *Data storag and retrieval, *Hydrologic data, *Information retrieval, *Information exchange, *Indexing, Bibliographies, Surface waters, Sediments, Groundwater, Water quality, *National Water Data Exchange(NAWDEX), Water Data Sources Directory.

This report describes the activities of the National Water Data Exchange (NAWDEX) during Fiscal Year 1978, October 1, 1977 through September 30, 1978. Discussions include program administration, NAWDEX services, identification of sources of water data, indexing of available water data, development of systems to be used with the NAWDEX data bases, Water Data Sources Directory, and Master Water Data Index. (Woodard-USGS)
W79-04392

BALANCING THE INTERESTS. THE THIRD UN-LAW OF THE SEA CONFERENCE - (7TH SESSION),
For primary bibliographic entry see Field 6E.
W79-04441

TO ESTABLISH A NATIONAL WATER POLICY.
For primary bibliographic entry see Field 6E.
W79-04447

10B. Reference and Retrieval

REPORT ON CIBOLA DIVISION (6) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact and Research.
For primary bibliographic entry see Field 6B.
W79-04105

REPORT ON IMPERIAL DIVISION (7) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
For primary bibliographic entry see Field 6B.
W79-04106

REPORT ON LAGUNA DIVISION (8) OF DIVISIONAL OUTDOOR RECREATIONAL USE AND PARTICIPATION INVENTORY OF THE LOWER COLORADO RIVER,
Arizona State Univ., Tempe. Area of Recreation Impact Research.
For primary bibliographic entry see Field 6B.
W79-04107

STATUS OF THE NATIONAL WATER DATA EXCHANGE (NAWDEX)--SEPTEMBER 1978,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 10A.
W79-04392

10D. Specialized Information Center Services

COMPUTER PROGRAMS IN WATER RESOURCES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 7C.
W79-04081

FINITE ELEMENT SOLUTION OF SAINT-VENANT EQUATIONS,
Nevada Univ., Reno.
R. L. Cooley, and S. A. Moin.
Journal of the Hydraulics Division, ASCE, Vol. 102, No. HY6, p 759-775, June 1976. 6 fig, 1 tab, 20 ref, 2 append. OWRT B-078-NEV(1).

Descriptors: *Equations, *Saint-Venant equations, Hydrology, Channels, Flood routing, Groundwater, Surface water, Mathematics, Surface-groundwater relationships.

A finite element solution for the open-channel flow equations is presented. These equations, developed to provide reliable methods to route flood waves or other disturbances along open channels, investigate the interrelationships between groundwater and surface water. In this work the finite element scheme is based on the Galerkin method. The solution method is described, followed by examples of the comparison of results with those of some other researchers. Three cases solved with this element solution are present. Conclusions drawn from this study include: (1) the Saint-Venant equations can be solved using the finite element method presented; (2) the predictor-corrector method was stable and accurate, but the implicit-explicit scheme produced oscillatory results and became unstable for a problem involving a large degree of nonlinearity; and (3) small time steps would have to be used to guarantee accuracy and stability of the implicit-explicit method. (Davison-IPA)
W79-04100

FORTRAN IV PROGRAM TO COMPUTE DIVERSITY INDICES FROM INFORMATION THEORY,
Kansas Univ., Lawrence. Dept. of Geology.
R. L. Kaesler, and P. S. Mulvany.
Computers and Geosciences, Vol. 2, p 509-514, 1976. 10 ref. OWRT C-6007(No 5200)(1), 14-31-

001-5200.

Descriptors: *Computer programs, *Programming languages, *Digital computers, Computer models, Data processing, Information retrieval, Equations, Geology, Sedimentation, Sedimentology, Sediment sorting, Systems analysis.

Diversity indices adopted from information theory are used to measure the structure of fossil communities. For comparison purposes, diversities are based on a constant number of individuals. A program computing diversity indices and related statistics of the total collection and a randomly selected subset is presented. This program consisting of the four principal sections, input, random sampling procedure, computation of diversity and equitability, and output, also includes a data deck and glossary of variables. A sample data deck is provided as a model. Each data deck generates one page of output containing identification information, input data, and two sets of output -- one for total sample and one for the random sample. Diversity indices and related statistics are discussed with regard to the appropriate conditions for using the equations which are employed in this program. (Davison-IPA)
W79-04262

FORTRAN IV PROGRAM TO COMPUTE REPLICATED DIVERSITY INDICES FOR RANDOM SAMPLES OF SPECIFIED SIZE,
Kansas Univ., Lawrence. Dept. of Geology.
R. L. Kaesler, and P. S. Mulvany.
Computers and Geosciences, Vol. 2, p 515-519, 1976. 4 ref. OWRT C-6007(No. 5200) (2), 14-31-001-5200.

Descriptors: *Computer programs, *Programming languages, *Digital computers, Computer models, Data processing, Data transmission, Information retrieval, Geology, Equations, Sedimentology, Sediment sorting.

Diversity indices adopted from information theory are used to measure the structure of fossil communities, and are usually based on a constant number of individual/collection. A program comparing diversities of large collections with diversities of small collections is presented. The program, consisting of five subsections to control input, printing of page headings, procedure for random sampling, computation of diversity, and output, includes three subroutines, FACT, DIVERS AND APPROX. It operates in two modes controlled by the option variable JOPT, and has a fully documented data deck. A sample data deck is provided. Each page of output contains a sample identification, the number of individuals in the random sample, the number of replications in the random sample, and the diversity indices which are arranged in two columns. (Davison-IPA)
W79-04263

FORTRAN IV PROGRAM TO COMPUTE HIERARCHICAL DIVERSITY,
Kansas Univ., Lawrence. Dept. of Geology.
P. S. Mulvany, and R. L. Kaesler.
Computers and Geosciences, Vol. 2, p 521-529, 1976. 1 fig, 5 ref. OWRT C-6007(5200)(3).

Descriptors: *Computer programs, *Programming languages, *Digital computers, Data processing, Geology, Data transmission, Information retrieval, Equations, Documentation, Animal groupings, Systematics.

In using indices of species diversity from information theory to assess fossil communities, diversity may be partitioned hierarchically to determine the diversity of orders, families within orders, genera within families, and species within genera. A program is presented which is designed for a two-, three-, or four-leveled taxonomic hierarchy. The option variable, JOPT, assigned a value of one, two, or three for the two-, three-, and four-leveled situations, controls the operational mode. The program was written using species as the first level, genus as the second level, family as the third level, and order as the fourth level. There are five sections and two subroutines in the program. The first section controls data input and the second computes the number of individuals in each tax on and the total number of individuals in the sample. The third section has four nested loops that compute ordinal diversity familial diversity of orders, generic diversity of families, and species diversity of genera. The fourth section computes composite diversities for each hierarchical level. The program also has a documented data deck and a glossary of variables. (Davison-IPA)
W79-04264

HYDRAULICS IN THE COASTAL ZONE.
For primary bibliographic entry see Field 2L.
W79-04351

10F. Preparation Of Reviews

TWELFTH ANNUAL REPORT, PROGRAM ACTIVITIES, JULY 1, 1975-JUNE 30, 1976.
Maryland Univ., College Park. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-290 958, Price codes: A04 in paper copy, A01 in microfiche, 1976. 59 p, 4 fig, 1 tab, 3 ref, 3 append. OWRT-A-999-MD(12).

Descriptors: *Water resources, *Maryland, *Organizations, Planning, Chesapeake Bay, Effluents, Sewage, Environmental effects, Cooling towers, Irrigation, Microbiology, Microorganisms, Bacteria, Viruses, Fishes, Toxicity, Sediments.

The current activities (1975-76) of the Maryland Water Resources Research Center are summarized. This institution, established in 1965, continues to stimulate, facilitate, support and coordinate reseach in the full spectrum of water-related problems and disciplines, with emphasis on reseach relevant to Maryland. The current status of the following projects is reported: heavy metals and minerals in Chesapeake Bay sediments; toxicity of waste water treatment plant effluents to fishes; mathematical model for estimating water quality loadings; groundwater fluctuation under heavy irrigation with sewage effluents; treatment costs versus environmental damage in state water resources management; water quality changes in oyster processing; mutagenic potential of petroleum byproducts in Chesapeake Bay waters; detection of enteroviruses surviving standard sewage treatment; detection of bacterial pathogens surviving standard sewage treatment; biotoxicity of chlorine species to copopeds; marsh ecosystem response to nutrients in agricultural runoff; characteristics of urban runoff, and the effects of a cooling tower on the environment. (Davison-IPA)
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W79-04496	4B
W79-04497	6B
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W79-04499	5D
W79-04500	5B

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-04130--04131 04162 04164--04171 04173--04218 04220, 04223 04226--04238 04348--04349 04500	75
DOE Oak Ridge National Laboratory, Nuclear Radiation and Safety	W79-04070	1
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-04256 04277--04278	3
Illinois State Water Survey, Hydrology	W79-04021 04037--04069 04072 04083--04084 04088, 04090 04092 04122--04125 04128, 04149 04155, 04163 04172, 04222 04351--04388 04498	89
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W79-04219, 04221 04224--04225 04253--04255 04257--04258 04279, 04286 04290, 04295 04305, 04400 04416, 04423 04499	18

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE (CONTINUED)		
National Water Well Association, Water Well Construction Technology	W79-04239--04251	13
University of Arizona, Arid Land Water Resources	W79-04280--04285 04287--04289 04291--04294 04296--04304 04306--04307	24
University of Florida, Eastern U. S. Water Law	W79-04346--04347 04415 04417--04422 04424--04458	44
University of North Carolina, Metropolitan Water Resources Planning and Management	W79-04135--04148 04150--04154 04156--04158	22
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-04007--04010 04071 04073--04079 04085--04087 04089, 04091 04093 04119--04121 04126--04127 04129 04132--04134 04159--04160 04259--04261 04308--04312 04350, 04389 04483--04487 04492--04497	50
C. OTHER		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-04313--04345	33

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
Information Planning Associates, Inc.	W79-04001--04006 04011--04017 04094--04118 04252 04262--04276	54
Ocean Engineering Information Service (Patents)	W79-04459--04481	23
Office of Water Research and Technology	W79-04080--04082 04161, 04482 04489--04491	8
U. S. Geological Survey	W79-04018--04020 04022--04036 04390--04399 04401--04414	42

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WATER RESOURCES ABSTRACTS

A. CENTERS OF COMPETENCE (CONTINUED)		
National Water Well Association, Water Construction Technology	W79-04239--04251	
University of Arizona, Arid Land Water Resources	W79-04280--04285 04287--04289 04291--04294 04296--04304 04306--04307	
University of Florida, Eastern U. S. Water Law	W79-04346--04347 04415 04417--04422 04424--04458	
University of North Carolina, Metropolitan Water Resources Planning and Management	W79-04135--04148 04150--04154 04156--04158	
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-04007--04010 04071 04073--04079 04085--04087 04089, 04091 04093 04119--04121 04126--04127 04129 04132--04134 04159--04160 04259--04261 04308--04312 04350, 04389 04483--04487 04492--04497	
C. OTHER		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W79-04313--04345	